

An Introduction to Design Thinking:  
Implications and Applications in K-12 Educational Institutions  
By  
Shawn Thomas Loescher  
Urban Discovery Schools  
Michèle Morris  
University of California at San Diego  
Tali Lerner  
Urban Discovery Schools

CENTER FOR SECONDARY SCHOOL REDESIGN

Annual Conference, San Diego, CA

February 2019

**Author's Notes**

Shawn Thomas Loescher, Chief Executive Officer, Urban Discovery Schools.

Michèle Morris, Assistant Director of the Design Lab,

University of California at San Diego.

Tali Lerner, Dean of Student Innovations, IDEATE High Academy,

Urban Discovery Schools.

Correspondence should be addressed to Urban Discovery Schools,

840 14<sup>th</sup> Street, San Diego, CA, 92101. Email: [ceo@urbansd.com](mailto:ceo@urbansd.com).

## ABSTRACT

Design thinking (DT) is both a method and mindset applicable in a broad range of fields and industries. Some of the defining features of DT included focusing on need definition before problem solving, abdication of preconceived outcomes, being situated towards ambiguity, being human-centric, and having a reflexive process that seeks to increase contextual knowledge using empathy as the basis of understanding. Based on a review of the literature and the authors professional experience, we proposed an operational definition of DT, described several of the methodologies and attributes of DT, situated DT within a philosophical framework, and discussed implications to practice in K-12 educational institutions. We argued that DT represents the operationalization of constructivist practice for learning and can be applicable to all aspects K-12 educational institutions including leadership and operations.

*Keywords:* Design thinking, constructivism, philosophical framework, education, human-centered design



An Introduction to Design Thinking:  
Implications and Applications in K-12 Educational Institutions

Design thinking (DT) is both a method and an orientation towards innovation and improvement that has been applied to a variety of industries and social settings (Yee, Jefferies & Michlewski, 2017; Orthel, 2015). Rather than whole scale improvement initiatives that seek out process efficiencies for generalizability, such as Lean Six Sigma (George, 2010) or the Learning Organization (Senge, 1990), DT situates itself within continuous improvement that is focused on human-centric experience (Gallagher & Thodarson, 2018; Biffi, Bissola & Imperatori, 2017; Silverman, 2017). In this way DT seeks out solving the “right” problem in any given context and considers the people within that ecosystem. While DT has been used in educational settings (Gallagher & Thordarson, 2018; Loescher 2018; Scheer, Noweski & Meinel, 2012), there remains many questions about how it can be aligned to the current educational landscape, K-12 institutions and redesign initiatives.

The purpose of this introduction to DT was to engage the reader in the background of DT, create an operational definition of DT that can be applied to education, present some of the prevailing models of DT as a method, and situate DT within a larger philosophical framework. In particular, this review was intended as an introduction to DT to allow for the researchers to explore some of the implications and application of DT in K-12 educational settings. This conference paper sought out to answer the questions of (1) what are the background and traditions of design thinking? and (2) what may be some of the implications to practice in K-12 educational institutions?

## Method

This conference paper was developed using a qualitative heuristic approach and self-study of empirical practice of the researchers. It involved a review of both primary and secondary source literature through a qualitative constructivist process. In our method we selected quotes from the literature in a process of sense making of the topics being studied. These quotes were then coded, sorted, and reviewed through analytic memos and active reflections (Charmaz, 2017; Saldaña, 2016). In this process, emergent themes were constructed as it pertained to the background of DT to develop an operational definition, situate DT within a philosophical framework and discuss implications to practice in K-12 educational institutions.

We also reviewed current practices at the University of California at San Diego Design Lab and Urban Discovery Schools (UDS). The purpose of our review of practice was to provide examples of how DT was being used within an educational organization in the Southwest, United States. Our review included how the University of California at San Diego Design Lab and UDS partnership put into practice transformational models of both organizational development and pedagogical practice to advance student achievement within their adoption of DT. These practices were also shared with scholars working on DT in education including those at the Office of Scholarship and Innovation at the Mary Lou Fulton Teachers College at Arizona State University (Scragg, Warr & Mishra, 2018). The authors also relied upon their professional experience in the implementation and adoption of DT in both professional and academic settings. These experiences were considered relevant as part of a critical approach of this work (Denzin & Lincoln, 2011).

### **Literature Review and Framework of Design Thinking**

The development of DT can be traced back to the 1950's and is grounded in the theories, practices and traditions of design sciences (Orthel, 2015) and psychology (Biffi et al., 2017; Coyne, 2005). Design is an anticipatory and problem-solving activity (Silverman, 2017; Yee et al., 2017; Elwood, Savenye, Jordan, Larson, & Zapata, 2016) applicable to a wide variety of situations including complex problems (Biffi, 2017; Jordan, 2016; Coyne 2005). Many scholars point to Rowe's 1987 work on 'design thinking' as the formalization of the terminology of DT (Mosely, Wright & Wrigley, 2018). Rowe is often cited in the literature as developing DT methods and making historical connections of how DT originates from the practices of designers (Orthel, 2015; Razzouk & Shute, 2012).

DT has been described by some as being a methodology (Henriksen, et al., 2018; Biffi et al., 2017; Elwood et al., 2016). However, it is also marked by a change in approach to problem solving (Henriksen et al., 2018; Jordan, 2016; Orthel, 2015). This includes the embracing of certain methodological techniques such as prototyping, but also asks a mindset whereby one should be open to solutions that are both unknown and evolutionary in nature (Biffi et al., 2017; Yee et al., 2017). This may place DT within the branch of improvement models that has been characterized by Argyris and Schön as being focused on continuous improvement (Cousins, 2018) while embracing the rhizomatic ambiguity of postmodernist such as Deleuze and Guattari (Biffi et al., 2017; Coyne, 2005). As a model of learning and understanding, rhizomatic concepts create a multiplicity of thoughts and realities (Deleuze & Guattari, 1987).

### **Method and Mindset of DT**

While the ideas of DT have been popularized by organizations such as IDEO and institutions such as Stanford University (Mosley et al., 2018; Yee et al., 2017; Elwood et al.,

2016), there is no fixed definition or method of DT. Moreover, DT is often directly or indirectly used synonymously with related but separate terms such as, but not limited to, user experience, human-centered design, and human factors. Scholars have recommended that the successful implementation DT may be facilitated by a customized organizational practice developed during the adoption of the innovation of DT (Gallagher & Thordarson, 2018; Silverman, 2017; Yee et al., 2017). In this way, DT becomes part of the designerly ways upon which organizations can grow. Scholars and practitioners also recommend several models to start the process of implementing DT in an organization (Yee et al., 2017; Orthel, 2015).

Many of the key components of DT can be grouped into two categories, that of methodology and that of mindset or disposition. There are a variety of methodological approaches associated with DT (Gallagher & Thordarson, 2018; Biffi et al., 2017; Orthel, 2015). As a starting point many organizations adopt the IDEO model (Mosely, 2018; Yee et al., 2017; Elwood et al., 2016). This five-step model represents the reflexive steps of (a) emphasize, (b) define, (c) ideate, (d) prototype, and (e) test (Yee et al., 2017). As previously reviewed, an adaptation of DT may become part of the process for organizational adoption. Several common attributes in this process have been found (Yee et al., 2017; Biffi et al., 2017; Orthel, 2015).

For example, Yee et al. (2017) conducted case studies of 13 organizations that had adopted DT and found that many had moved away from the IDEO DT model. These organizations included large private businesses, non-profit organizations, and government institutions. The implementation of DT in these organizations held the common attributes of continuing to go through processes of empathetic reflection, ideation, and prototyping to scale efforts (Yee et al., 2017). Research studies on DT show similar attributes of phases of empathetic

discovery, ideation, and prototyping to achieve a promising implementation model (Henriksen et al., 2018; Biffi et al., 2017; Coyne, 2005).

From the perspective of mindset and dispositions, the literature suggests that there are several common characteristics of organizations that have adopted DT. Here we have identified four areas that emerged in the literature. These included being human-centered, embracing ambiguity, being highly reflexive, and involving visualization of data. Here we briefly explore each of these areas.

The human-centered disposition of DT is a critical attribute of how problems are approached (Biffi et al., 2017; Yee et al., 2017). This sets DT apart from movements such as Senge's (1990) Learning Organization, which focuses on systems thinking from a process and procedures point of view (Yee et al., 2017). Within DT's human-centricity the needs of customers, users, targeted audiences, and those that serve them are tied together through a reflective and empathetic process (Gallagher & Thordarson, 2018; Henriksen et al., 2018; Orthel, 2015). Therefore, rather than discounting the humans as an apparatus of process, the people become the focal point whereby everyone within the ecosystem is intrinsically tied.

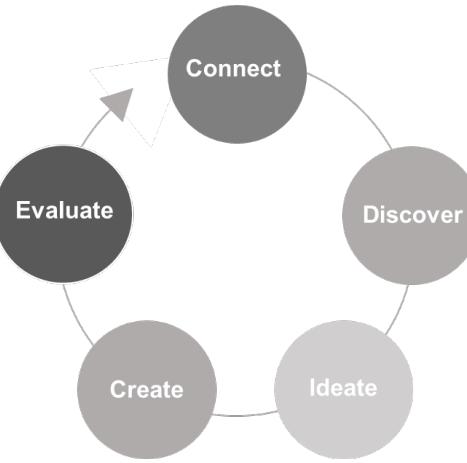
The use of DT requires people to become accustomed to ambiguity (Henriksen et al., 2018; Elwood et al., 2016; Jordan, 2016). By relinquishing preconceived notions of what an outcome might be, those participating on a DT team are able to more deeply empathize in the human-centered process. This facilitates the exploration of ideas that may have been concealed by this ambiguity or disregarded as a result of traditional organizational and team constraints and power dynamics. This embracing of ambiguity also permits an organizations' DT method to become highly reflexive and non-linear (Biffi et al., 2017; Jordan, 2016; Orthel, 2015). In this way, the DT method was not a permanent or semi-permanent series of action steps, but rather

guidelines for action that are inherently flexible and able to bend back upon each other to create a type of rhizomatic flow (Biffi et al., 2017; Elwood et al., 2016; Coyne, 2005).

Finally, DT often involves visualizing data in a process of sense making (Biffi et al., 2017; Yee et al., 2017). Perhaps the most recognizable of DT practices is the ideation process whereby ideas are placed on sticky notes and then organized into themes. The human-centered approach of DT cautions against the overuse of strictly quantitative data (Gallagher & Thordarson, 2018). This moves those involved in DT into a focus on mix-methods technique where ideas are created within a multidisciplinary group environment. The visualization of the produced ideas is both an acceptable and necessary way for participants to make sense of the collective data. In this way DT can use multi-strand methods that allow for explanatory research design models. A multi-strand explanatory research design is used when there is not clearly established previous research and is characterized by the use mixed methods with the qualitative data being utilized to explore and create operational definitions of the problem to be addressed (Ivankova, 2016; Creswell, 2015). This method may be appropriate when the previously established research appears to be limited in depth or breadth for the evolving context or marketplace.

### **Operational Definition Philosophical Framework of DT**

To support our ongoing work, we adopted an operational definition of DT as being a highly reflexive, non-linear process that involved empathetic exploration of a topic through mixed-methods with data visualization. It was inclusive of the development of prototypes through ideation, with the testing of promising prototypes in search of the next iteration of empathetic exploration. This operational definition allowed for UDS to develop and explore various models that allow for a continuous growth cycle for improvement (see Figure 1).



*Figure 1.* Design thinking methods model adopted by Urban Discovery Schools

Scholars have argued that a philosophical framework should be considered when situating ground level change theories (Koro-Ljungberg, Yendol-Hoppey, Smith, & Hayes, 2009; Gutek, 2004; Crotty, 1998). It has been argued that philosophical dispositions have impacts to how educational changes are adopted (Loescher, 2018; Main, 2009; Gutek, 2004). Therefore, in addition to developing an operational definition of DT, we have proposed a theoretical alignment of DT within the field of philosophy (see Table 1). The purpose of this theoretical alignment was to facilitate our discussion of the implications and applications of DT within K-12 educational institutions.

Table 1

*Proposed Theoretical Alignment of Design Thinking*

Ontology	Epistemology	Theoretical Perspective	Methodology
Idealism	Subjectivism	Postmodernism/Critical Inquiry	Design Thinking

### **Discussion on Educational Implications and Applications**

Having reviewed the literature on DT, here we outline some of the implications and application in practice that may be adopted by K- 12 educational institutions. First, we engage in a discussion situating DT within normative educational philosophy and review a few of the implications to instruction, curriculum, and assessment. Then, we discuss how DT may be applied to educational institutions with an overview of aspects of school culture, organizational development, and school leadership. Finally, we discuss some of the challenges that may be associated with adoptions of DT by K-12 educational institutions. As with previous sections of this article, this is an overview of only a few of the areas of applicability.

### **Philosophical Disposition and Pedagogical Implications**

Philosophical dispositions have implications to curriculum, instruction, and assessment (Gutek, 2004). Therefore, within our theoretical framework, we extended DT's orientation into educational philosophy so that we could consider the implications to educational institutions and their practice. Based upon the postmodernism that we have argued that DT is situated within, we found that DT is applicable to the normative educational philosophy of *reconstructionism*. Reconstructionism has been defined as believing that we are obligated to recreate the world into a more ideal state of being with a focus on social issues (Gutek, 2004). Reconstructionism is most readily associated with the ontology of idealism, the epistemology of subjectivism, and is often associated with postmodernism and critical inquiry (Crotty, 1998). Here we will discuss a few implications to practice for instruction, curriculum, and assessment for those that engage in DT. Our intention is to create an opening discussion for the reader and the teams they are working with.

An implication to instruction may be that those who are engage in DT in the classroom should be grounded in constructivism. Scholars have argued that DT in the classroom is the operationalization of constructivist practice (Henriksen et al., 2018; Elwood, et al., 2016; Scheer et al., 2012). This may also involve advanced instructional strategies that intend to invoke critical reflection and thought process such as *deconstruction*. Deconstruction is a qualitative linguistic exploratory process whereby a text or subject is explored for hidden, unintended and multiple meanings that create additional possibilities for interpretation (Derrida, 1997).

The process of deconstruction involves examining preconceived notions and hierarchies to make room for transformational thinking (Royle, 2000). To facilitate such a process as an instructional strategy, the positionality of the teacher may need to be reoriented from that of subject matter expert to that of co-learner (Freire, 2011). This might also allow for a rhizomatic approach to learning that has been adopted by some DT scholars (Biffi, 2017; Coyne 2005). What becomes important is that teachers are trained on a variety of instructional practice so that they are able to facilitate the constructivist process.

For curriculum, many of the challenges associated with the successful application of DT pertain to high levels of context complexity or *wicked problems*. Wicked problems are socially grounded issues that are complex without clearly defined answers and are often interwoven with other problems that are equally complex (Rittel & Webber, 1973). While design concepts in education have been explored through essential questions with supporting frameworks (Wiggins & McTighe, 2005), practitioners of DT may need to pay attention to how those questions are framed. We argue that essential questions should set parameters to the learning activity, embrace ambiguity, and allow for a dynamic and generative facilitation of the process of learning.

Within DT, the pedagogical practice of using essential questions should not seek to eliminate discrete learning outcomes or the need for addressing procedural learning (Gallagher & Thordarson, 2018; Jordan, 2016; Wiggins & McTighe, 2005). Because of the fluidity of the constructivist practice that DT represents, outcomes of procedural learning may need to be explicitly defined as part of the curriculum design of each unit or project. With the defined outcomes in place, the teacher required to adjust instructional practice as a facilitator of learning a classroom learning community. As part of human-centered design, the development of curriculum and units of study in DT may require students to be involved. For example, at UDS secondary school units of study were subjected to a review by design teams with teachers and students examining outcomes and ideas for improving learning based upon their mutually defined human-center experience.

The use of DT does not negate a process of assessment. Rather, DT requires assessment and tests as a means of measuring progress and as part of the highly reflexive iterative cycle that it is engaged in (Biffi et al., 2017; Yee et al., 2017; Orthel, 2015). Assessment of many DT projects require a rubric or multiple data points to monitor student academic growth and data. As DT embraces ambiguity (Henriksen et al., 2018; Jordan, 2016; Orthel, 2015), outcomes of any DT cumulative process are not known at the onset. This requires multiple forms and modalities of assessments within design projects (Wiggins & McTighe, 2005) to allow the rhizomatic process the freedom to take shape (Henriksen et al., 2018; Biffi et al., 2017; Coyne, 2005). This does not dismiss current assessment models, inclusive of, but not limited to, classroom and standardized testing. Rather, DT is inclusive of many current assessments as part of multiple modalities to allow for an interpretation of results (Wiggins & McTighe, 2005).

Assessment within DT may need to allow for students to fail a DT project as part of the iteration of learning. This can occur through allowing students or design teams to demonstrate their learning through multiple modalities such as presentations, reflections, plans for their next iteration of learning, or other means of showing academic and personal growth. For example, at UDS a DT challenge asked students to explore a state electoral system. The design challenge was to develop a more just districting system that was representative of the population. The student design teams explored issue of social justice, legal aspects of redistricting, and statistics. After prototyping several systems, the design teams failed to find a way to design a system that would give what it deemed to be a fair representation for those of African American descent. This failure opened up a discussion for further exploration on the topic of designing a new type of electoral system that may be more just in a digital world that may not be based upon geographic districting.

### **Implications to School Culture, Organizational Development and Leadership**

As with areas associated with instruction practice, DT may have additional considerations K-12 educational institutions. It has been argued by scholars that DT has created more egalitarian approaches to decision making and flattened organizational structures (Gallagher & Thordarson, 2018; Yee et al., 2017). This may raise questions about implementing the innovation of DT that may have implications to school culture, organizational development and operations in our educational institutions. Primarily, we argue that educational institutions must not simply demand DT in the classroom, but must embrace DT as a means and mechanism with implications to every aspect of our classrooms, schools and districts.

The importance of school culture has been well established within the literature (Loescher, 2018; Sheehan & Rall, 2011; Ravitz, 2010; Yasso, 2005). Within the framework of

our operational definition of DT, we find that there are three primary aspects that must be considered. First, schools must be culturally responsive through an empathetic process that is inclusive of, but not limited to, those that attend the school. Next, school must be a safe place to earnestly try and fail for all people. Finally, how we provide leadership to our schools may have implications to the successful adoption of DT.

For student and parents, this may mean the exploration of topics as being co-constructed. For example, at UDS they were engaged in meeting structures call *Community Design Sessions*. This was a process for parents and students to move through DT cycles to address complex social issues such as racism, human sexuality, substance abuse, and the origination of personal belief systems that may cause biases. In this way, students and parents were taking on active participatory roles in a constructionist process. They were also engaging in reconstructionism by attempting to creating a more socially just world and providing voices to historically underrepresented and/or oppressed individuals, groups, and populations.

For faculty and staff, there may need to be substantial considerations for how their work performance is evaluated. Employees need to feel safe in engaging in DT and the process of continuously prototyping and testing new practice and process. For example, at UDS they have engaged in a redesigned human resource development and evaluation system that not only promotes the exploration and adoption of innovations, but also allows for those innovations to fail. In the UDS human resource development model, there was a baseline evaluation for all employees which primarily focused on being an effective member of the professional learning environment.

However, one section of the UDS evaluation system focused on the willingness to embrace change, tolerate ambiguity and engage in new practice. When performance

requirements were reached in this area there was the creation of a growth topic or goals. Once a growth topic or goal was established, there was a separate process to support the individual in their design cycle to develop an innovation to test. Regardless of the success of the innovation, the employee was asked to present to the team and share their learning.

With this support in place, at UDS teachers were using DT within the fields of curriculum development, mastery-based learning systems, grade reporting systems, reimagined classroom spaces, and student support systems. The most promising prototypes were brought to test during the school year. Teachers were not evaluated on the success or failure of their prototypes or pilot test, rather they were evaluated on their teamwork, work ethic, and willingness to share their learning and growth through the process. Sharing occurred at design team meetings, at professional development, and through progress checks that occur on a weekly basis. In those meetings, setbacks and failures were celebrated as part of the process of learning.

School and district leaders that wish to implement DT may need to do so using DT itself. This may require school leaders to be prepared strike a delicate balance between establishing expectations for DT while allowing for the co-creation of the processes and practices that operationalize it within the institution. We argue that one cannot simply order that constructivism occur in the classroom. Rather, we assert that school leaders should engage in the constructivist practice itself as part of implementing DT in all aspect of operations and instruction.

### **Challenges of Implementing DT in Education**

Implementing change in schools and educational institutions is a complex process (Yee et al., 2017; Hall & Hord, 2015). Several organizational change models suggest that the implementation of innovations is a communication process (Hall & Hord, 2015; Christensen,

Anthony & Roth, 2004; Rogers, 2003). As previously reviewed, DT draws on a heuristic inquiry and mixed-methods traditions as a means of constructing options of possible future states of being (Biffi et al., 2017; Orthel, 2015; Conye, 2005). This may situate DT as a means of addressing the challenges associated with implementation cycles (Gallagher & Thordarson, 2018; Yee et al., 2017). Here we review a few considerations of the challenges that have been highlighted in the literature and have been experienced by practitioners in the field of K-12 education.

It has been argued that education is a field that faces challenges in changing institutional norms because it is comprised of people that consider themselves experts in the way things should be done (Yee et al., 2017; Elwood et al., 2016). Within DT, there can be no singular expertise in an outcome of something that is not known. Therefore, the perception of the educator being the single expert qualified to make decisions about education may be a limiting factor. This is because such views may narrow the scope of exploration of possibilities of new ways of conducting educational activities and how they can be administered (Yee et al., 2017). This does not negate the expertise of those in education. Rather, it considers all of those within the ecosystem as experts either by way of training or experience. This ensures that attention is given to a distributed process that considers the concepts of equality and equity of all stakeholder. Here we explore two of the many areas where DT may face significant challenges.

The educational funding model is primarily driven by a calculation of instructional minutes through the administration of a master schedule (Townley & Schmieder-Ramirez, 2008). However, DT may involve a fluid process that requires modifications to school days, master schedules, and instructional minutes. Within DT learning models, individual seat time of students may become blurred as the focus is on continuous learning. By continuous learning, we mean

that regardless of the level of student achievement, even at levels significantly above grade level, students should be engaged in a cycle continuous learning. In addition, the master schedule may need modifications for block times to work on DT learning models. Depending upon the educational system, administration may be required within collective bargaining agreements to hold votes before modifying a master schedule.

Learning outcomes are often established within state education codes (Stark & Noel, 2015; Carlson & Planty, 2012). This may include, but not be limited to, the adoption of standards, course requirements for graduation, standardized testing requirements, and state mandated graduation exams. This may require an examination of the intentions of the education code and seeking out ways that it can be addressed in different ways. In some cases, the adoption of mastery-based learning criteria and systems may allow for more flexibility in the classroom and at the school level. For example, the implementation of DT within classrooms often represents the intersectionality of, rather than the division of, subject matter (Orthel, 2015). Mastery-based learning systems may allow school systems to monitor student progress across the ecosystem of subjects, topics, and learning outcomes while allowing for them to be monitored in multiple classrooms. This may also establish what criteria consideration should occur for a student to be deemed a completer of topic, unit of study or level subject matter.

### **Conclusion**

DT is an extension of design science and postmodern psychology that reaches back to the 1950's. Rowe is often credited with the formalization of the term DT (Gallagher & Thordarson, 2018). DT has been used to engage in wicked problems (Biffi et al., 2017; Coyne, 2005). This has included being applied in professional, social, and academic settings. We reviewed the literature and developed an operational definition of DT which included the characteristics of

being a reflective, human-centered, problem solving process that embraces ongoing empathetic practice, solving for unknown solutions, collaboration of a diversity of disciplines and thinking, prototyping, and continuous improvement. Our review placed DT as being within the philosophical framework of idealism, subjectivism, critical inquiry, and postmodernism. This situated DT within the normative educational philosophy of reconstructionism.

We argued that DT holds promise to K-12 educational institution as the operationalization of constructivist practice for students and teachers (Henriksen et al., 2018; Elwood et. al., 2016; Scheer, 2012). We found that the work of DT in K-12 education institutions may be supported by the adoptions of a philosophical framework to advance innovation through inspired and reasonable risk taking. This may involve periodic failures as part of the learning process of prototyping and testing. We also argued that the implementation of DT in the classroom should be mirrored by use of DT by school leadership and in all aspects of K-12 school and district operations. While there are many challenges involved in implementing DT within K-12 education, we found that they may be addressed with the use of DT itself. In this way, DT becomes transformational strategy for K-12 educational institutions that reshapes their ontological approach from accepting their state of being (Crotty, 1998) as a starting point in a journey of becoming (Gray, 2013).

## References

- Biffi, A., Bissola, R., & Imperatori, B. (2017). Chasing innovation: a pilot case study of a rhizomatic design thinking education program. *Education + Training*, 59(9), 957-977. doi: 10.1108/ET-01-2016-0007
- Carlson, D. & Planty, M. (2012). The ineffectiveness of high school graduation credit requirement reforms: A story of implementation and enforcement? *Education Policy*, 26(4), 592-626. doi: 10.1177/0895904811417582
- Charmaz, C. (2017). The power of Constructivist Grounded Theory for critical inquiry. *Qualitative Inquiry*, 23(1), 34-45. doi: 10.1177/1077800416657105
- Christensen, C. M., Anthony, S. D., & Roth, E. A. (2004). *Seeing what's next: Using the theories of innovation to predict industry change*. Boston, MA: Harvard Business School Press.
- Cousins, B. (2018). Validating a Design Thinking Strategy: Merging Design Thinking and Absorptive Capacity to Build a Dynamic Capability and Competitive Advantage. *Journal of Innovation Management*, 6(2), 102-120.
- Coyne, R. (2005) Wicked problems revisited. *Design Studies* 26, 5-17.  
doi:10.1016/j.destud.2004.06.005
- Creswell, J. W. (2015). *Educational research: Planning, conducting and evaluating quantitative and qualitative research* (5th ed.). Boston, MA: Pearson.
- Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. Thousand Oaks, CA: SAGE Publications.
- Deleuze, G., & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia*. Minneapolis, MN: University of Minnesota Press.
- Denzin, N. & Lincoln, Y. (2011) Introduction: The discipline and practice of qualitative research. In Denzin, N., & Lincoln, Y. (Ed.). *The SAGE handbook of qualitative research* (pp. 1-20). Los Angeles: SAGE Publications.
- Derrida, J. (1997). *Deconstruction in a nutshell* (Caputo, John ed.). New York: Fordham University Press
- Elwood, K., Savenye, W., Jordan, M. E., Larson, J., & Zapata, C. (2016). Design thinking: A new construct for educators. *Paper session presented at the Annual Convention of the Association of Educational Communications and Technology*, Las Vegas, NV.
- Freire, P. (2011). *Pedagogy of the oppressed* (30<sup>th</sup> anniversary edition). New York, NY: Continuum.

- Gallagher, A., & Thordarson, K. (2018). *Design thinking for school leaders: Five roles and mindsets that ignite positive change*. Alexandria, VA: ASCD Member Books.
- George, M. O. (2010). *The Lean Six Sigma guide to doing more with less: cut costs, reduce waste, and lower your overhead*. New York, NY: John Wiley & Sons, Inc.
- Gray, D. E. (2013). *Doing research in the real world*. Thousand Oaks, CA: SAGE Publications.
- Gutek, G. L. (2004). *Philosophical and ideological voices in education*. New York, NY: Pearson.
- Hall, G. E., & Hord, S. M. (2015). *Implementing change: Patterns, principles, and potholes* (4<sup>th</sup> ed.). Boston, MA: Pearson.
- Henriksen, D., Cain, W., & Mishra, P. (2018) Everyone designs: Learner autonomy through creative, reflective, and iterative practice mindsets. *Journal of Formative Design in Learning*, 1-14. doi: 0.1007/s41686-018-0024-6
- Ivankova, N. V. (2015). *Mixed methods applications in action research: From methods to community action*. Thousand Oaks, CA: SAGE Publications.
- Jordan, M. E. (2016). Teaching as designing: Preparing pre-service teachers for adaptive teaching. *Theory Into Practice*, 55, 197-206. doi: 10.1080/00405841.2016.1176812
- Koro-Ljungberg, M., Yendol-Hoppey, D., Smith, J., & Hayes, S. (2009). (E)pistemological awareness, instantiation of methods, and uninformed methodological ambiguity in qualitative research projects. *Educational Researcher*, 38(9), 687-699. doi: I0.3102/0013189X0935 1980
- Loescher, S. T. (2018). *Hope as strategy: The effectiveness of an innovation of the mind*. Tempe, AZ: Arizona State University.
- Main, K. (2009). "Mind the gap": cultural revitalization and educational change. *School Effectiveness and School Improvement*, 20(4), 457-478.
- Mosely, G., Wright, N., & Wrigley, C. (2018). Facilitating design thinking: A comparison of design expertise. *Thinking Skills and Creativity*, 27, 177-189. doi: 10.1016/j.tsc.2018.02.004
- Orthel, B. D. (2015). Implications of design thinking for teaching, learning, and inquiry. *Journal of Interior Design*, 40(3), 1-20.
- Ravitz, J. (2010). Beyond changing culture in small high schools: Reform models and changing instruction with project-based learning. *Peabody Journal of Education*, 85(3), 290-312.
- Razzouk, R., & Shute, V. (2012). What is design thinking and why is it important? *Review of Educational Research*, 82(3), 330-348. doi: 10.3102/0034654312457429

- Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), 155-169.
- Rogers, E. M. (2003). *Diffusion of innovations*. New York, NY: The Free Press.
- Royle, N. (2000). Deconstructions: A user's guide. New York, NY: PALGRAVE.
- Saldaña, J. (2016). *The coding manual for qualitative researchers (3<sup>rd</sup> ed.)*. Thousand Oaks, CA: SAGE Publications.
- Scheer, A., Noweski, C., & Meinel, C. (2012). Transforming constructivist learning into action: Design thinking in education. *Design and Technology Education: An International Journal*, 17(3).
- Scragg, B., Warr, M., & Mishra, P. (2018, March). *The five discourses of design and educational technology*. A conference paper presented at the American Association of Educational Research Annual Conference 2018. Toronto, ON.
- Sheehan, K., & Rall, K. (2011). Rediscovering hope: Building school cultures of hope for children of poverty. *Phi Delta Kappan*, 93(3), 44-47.
- Silverman, H. (2017). Designerly ways for action research. In H. Bradbury (eds.) *The SAGE handbook of action research*. London, UK: SAGE Publications Ltd. doi: <http://dx.doi.org/10.4135/9781473921290>
- Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York, NY: Currency Doubleday Books.
- Stark, P. & Noel, A. M. (2015). *Trends in high school dropout and completion rates in the United States: 1972-2012*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education: Washington, DC.
- Townley, A. J., & Schmieder-Ramirez, J. H. (2008). *School finance: A California perspective (8<sup>th</sup> ed.)*. Dubuque, IA: Kendall/Hunt Publishing Company.
- Wiggins, G., & McTighe, J. (2005). *Understanding by design: Expanded 2nd edition*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race Ethnicity and Education*, 8(1), 69-91. doi: 10.1080/1361332052000341006
- Yee, J., Jefferies, E., & Michlewski, K. (2017). *Transformations: 7 roles to drive change by design*. Amsterdam, NL: BIS Publishers.