

## Chapter 17

# Interweaving the Digital and Physical Worlds in Collaborative Project-Based Learning Experiences

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### ABSTRACT

*The purpose of this chapter is to help educators and educational scholars consider new possibilities for interweaving the digital and physical worlds in order to reconsider disciplinary and interdisciplinary learning across academic curricula. To explore how print and digital media may be interwoven to support children's creation of physical artifacts in project-based learning environments, the author describes uses to which students in one fifth grade class put multimodal print and digital texts as they collaborated in small groups to design robots. The author identifies the range of textual resources used across phases of the engineering design task in order to examine the interplay between digital and print-based texts in the design and production of physical artifacts. Focusing on the role of digital texts in this project-based learning experience, episodes of collaborative talk illustrate student processes of consuming and producing texts.*

### INTRODUCTION

Digital technologies have changed everyday aspects of life in the 21<sup>st</sup> century: automated doorways allow easy entrance to buildings, innovations in surgical procedures sustain life,

and geographic information systems transform scientific exploration and travel planning. Such changes would hardly be possible without the aid of digital literacy tools such as computer-aided drafting, computer simulations, and virtual communication used by designers and engineers. A

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transactional relationship clearly exists between technology and literacy (Coiro, Knobel, Lankshear, & Leu, 2008; Stolle, 2007). Less clear is the potential of digital technologies to shape children's literacy development and identities. Nevertheless, educators are incorporating digital technologies and digital texts into their classroom practices. Researchers are documenting these instructional practices (e.g., Bonk & King, 1998; Loveless, 1999; Miller & McVee, 2012; Pahl & Roswell, 2011) as well as the home digital literacy practices children and adolescents bring to school that then shape curricular activities (e.g., Alvermann, 2002; Chandler-Olcott & Mahara, 2003; Lewis & Fabos, 2005).

One way curricula are being shaped by digital texts is through project-based instruction (Lewis, 2006; Luke, 2003). The 21<sup>st</sup> century world is increasingly complex and fast-paced, requiring diverse perspectives, interdependent actions, and problem-focused solutions. In recognition of this reality, some scholars are urging educators and researchers to turn attention from discipline-based inquiry to problem-based and project-based learning (e.g., Lewis, 2006; Schank, 2011). Robotic engineering design projects offer one avenue to explore the possibilities of digital texts for transforming curricula, particularly with many states adding engineering skills and knowledge objectives to K-12 standards (e.g., creating solutions, prototypes, and graphics; knowledge of engineering fields) (Carr, Bennett, & Strobel, 2012; National Research Council, 2009, 2011). Such projects offer students context in which complex multimodal literacy experiences interact with hands-on production of physical products.

This chapter considers how print and digital media can be interwoven to support children's design and creation of physical artifacts in project-based learning environments. I describe the uses to which students in one fifth grade class put multimodal literacy resources as they collaborated in small groups to design robots. These students identified, located, consumed, and produced a

plethora of texts – both digital and print-based – across the 14 days they labored to produce and present their projects in a school-wide robotics fair. These multimodal texts ranged from completely alphabetic (i.e., composed of alphabetic language) to entirely inscription-based (e.g., graphs, sketches, iconic programming, mathematical formulas). By identifying textual resources used across phases of the design task and sharing illustrative episodes of collaborative talk, my aim is to help educators and educational scholars consider possibilities for interweaving the digital and physical worlds through project-based instruction. Two lines of scholarly work seem particularly relevant to this end: (1) literacy research describing multimodal literacy production as designing, and (2) research on engineering design processes.

## **BACKGROUND**

### **Literacy as Design**

Theoretical frameworks of new literacies (Kist, 2005; Lankshear & Knobel, 2006), new literacy studies (Street, 2003), multiliteracies (Cope & Kalantzis, 2000; New London Group [NLG], 1996), and multimodal literacies (Kress, 2003, 2010) differ in important ways. However, one of their common rationales for re-conceptualizing literacy is recognition of changes to social, personal, and work lives due to the emergence of digital technologies and the variety of text forms arising with them (NLG, 1996). Such changes require new forms of communicative competence, new purposes for engaging in literacy practices, and new forms of literacy education (Cope & Kalantzis, 2000; Street, Kate, & Rowsell, 2010).

The unprecedented growth of computer-based digital technologies and the quick access to multiple modes of representation they afford has spurred educational research on changing classroom and home practices associated with digital texts (Miller & McVee, 2012). More studies

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