# Invent to Learn: Making, Tinkering, and Engineering in the Classroom

# Book Club Study Guide and Additional Resources

Book website: [*http://inventtolearn.com*](http://inventtolearn.com/)

*Resources:* [*http://inventtolearn.com/resources*](http://inventtolearn.com/resources)

## Week 1 – Introduction, Chapters 1, 2 - Standing on the Shoulders of Giants

* CHAPTER 1 AN INSANELY BRIEF AND INCOMPLETE HISTORY OF MAKING - The modern maker movement is placed in a historic educational context.
* CHAPTER 2 LEARNING - Constructionism is a learning theory strongly resonant with the maker movement. We look at learning through the lenses of making, tinkering, and engineering.

### Week 1 Discussion Starter - Standing on the Shoulders of Giants

Week 1 of the Invent To Learn Book Club focuses on how we "stand on the shoulders of giants" - the scholars and practitioners in our field who wrote and created lasting works that offer timeless lessons.

Discussion starter:

Prior to reading “Invent To Learn,” how familiar were you with the work of:

* Rousseau
* Pestalozzi
* Froebel
* Maria Montessori
* John Dewey
* Jean Piaget
* Herbert Kohl
* John Holt
* Seymour Papert
* Nicholas Negroponte

### Week 1 - Learning Stories

Share a learning story.

### Week 1 - Making Today vs. Yesterday

Do the ideals of the maker movement seem more or less than your educational experience as a student? Are schools more or less hospitable to learning-by-doing today?

### Week 1 – Play

In children, it is generally accepted that play is a powerful way to learn. How does this change as we get older (or does it)?

### Week 1 - Favorite Learning Books

What is your favorite book about learning? Why?

### Week 1 - Constructionism is...

Define constructionism in your own words.

### Week 1 HOMEWORK

Read Twenty Things to Do With a Computer (1971) <http://stager.tv/blog/?p=1616> - This groundbreaking work was published in 1971. How does your school practice compare against these predictions from over 40 years ago?

Before next week -

Choose one of these Seymour Papert or Edith Ackermann videos and start a new topic to discuss your thoughts about it.

(Papert videos on <http://www.inventtolearn.com/papert-videos/>)

* [Seymour Papert in Sydney, Australia 2004](https://vimeo.com/9092144)  <https://vimeo.com/9092144>
* [Seymour Papert at Bates College - 2000](https://vimeo.com/9106174)
* [Seymour Papert keynote address at Mindfest 1999](https://vimeo.com/42020995)

(Ackermann videos on http://www.inventtolearn.com/ackermann-videos/)

* [Edith Ackermann: The Craftsmen, The Trickster and The Poet](http://www.exploratorium.edu/knowing/video.php?videoID=1241851064001) (2012)
* [Edith Ackermann on Constructivism, Constructionism, Social Constructivism and Today's Child](https://vimeo.com/22790848)
* [Playful Inventions and Explorations: What’s to Be Learned from Kids?](http://www.walkerart.org/channel/2010/playful-inventions-and-explorations-whats-to-) (2010) with subtitles

## Week 2 - Chapter 3 – Invention, Design, and Powerful Ideas

This week’s topic is invention, which is a process that involves thinking, design, and powerful ideas.

### Hard and Soft Mastery

The book paraphrased the incredibly powerful paper [Epistemological Pluralism and the Revaluation of the Concrete](http://papert.org/articles/EpistemologicalPluralism.html) by Sherry Turkle and Seymour Papert to illustrate different types of mastery. Can you share experiences (personal or of students) that demonstrate the distinction between hard and soft mastery?

If you’d like to read the whole paper (highly recommended) it is here: <http://papert.org/articles/EpistemologicalPluralism.html>

### Iterative Design

Does iterative design work for all subjects and classroom projects? Why or why not?

### Is Education Changing?

Do you see evidence that the “three reversals” supporting school reform discussed at the end of Chapter 3 are happening?

### Future predictions

Watch Nicholas Negroponte, the founder of the MIT Media Lab in his TED Talk from 1984. Then listen to a 2013 NPR interview with Negroponte

* **Nicholas Negroponte: 5 predictions, from 1984** <http://www.ted.com/talks/nicholas_negroponte_in_1984_makes_5_predictions.html>
* **5 Predictions Revisited** <http://www.npr.org/2013/09/13/215827198/how-do-you-predict-the-future>

Why are these future predictions important for teachers to think about?

### Homework:

1. Watch [Mike Eisenberg at Constructionism 2012](https://vimeo.com/49891132)

2. In this TED talk from 2005, Neil Gershenfeld, head of MIT’s Center for Bits and Atoms, describes an outreach program his center had recently begun called Fab Labs. Gershenfeld maps the beginnings of these fabrication laboratories that enabled ordinary people to build things they never dreamt they could.

http://blog.ted.com/2009/08/11/fab\_labs\_neil\_g/

## Week 3 - Chapters 4,5 Teaching for Invention

Welcome to week 3 of the Invent to Learn Book Club. This week we start to turn from theory to practice as we explore what projects and classroom practice.

### Video Discussion Starter – Strategies for Hands-on Learning

At the May 2012 Bay Area Maker Faire, Steve Hargadon interviewed Gary Stager about learning through making and tinkering. <http://vimeo.com/57356156>

Reply to this topic with any thoughts about these strategies.

### Questions:

1. Is project-based learning the way you teach?
2. Were there any teaching methods that resonated with you in these chapters or in the video? Any that seemed unreasonable?
3. Have you tried any of the suggestions to change teaching practice? What were the results?
4. The Next Generation Science Standards make explicit calls for meaningful assessment, interdisciplinary knowledge, inquiry, and engineering. Will this happen in your school?
5. Do you agree or disagree with the list of reasons in Chapter 4 that rubrics may be counterproductive?

### Homework:

* Evaluate one of your favorite classroom projects against the “standards” outlined in these chapters.
* Design a prompt that might result in students learning similar things to your favorite project. Describe learning objectives, materials required and time allotted.

## Week 4 - Chapters 6,7,8 The Stuff of Making, Both Old and New

CHAPTER 6 MAKING TODAY - Making in the classroom is not new; we connect new materials to time-honored learning opportunities.

CHAPTER 7 THE GAME CHANGERS - Three activities of the modern maker movement can revolutionize learning: fabrication, physical computing (robotics, Arduino, etc.), and programming.

CHAPTER 8 STUFF - You were wondering where the shopping list was!

### Questions:

1. Does “making” mean making anything? Are there some experiences or materials that are more valuable than others?
2. Please share any experiences in the classroom with any of the game-changer technologies. Successes and lessons learned are equally welcome!
3. If you have some ideas for your classroom you would like to share with the group, please feel free to share for others to comment on.
4. What is one thing you will do in developing understanding of or fluency with the three game-changing technologies from Chapter 7?

Homework:

Read: Computer As Material, Messing About with Time.

For Game changers:

Neil Gershenfeld's TED Talk, [The beckoning promise of personal fabrication](http://www.youtube.com/watch?v=5n-APFrlXDs) What comes after the digital revolution?

2009 TED Talk, [Neil **Gershenfeld**: Unleash your creativity in a Fab Lab](http://www.ted.com/talks/neil_gershenfeld_on_fab_labs.html)

Neil Gershenfeld's [How to Make Almost Anything presentation](http://www.youtube.com/watch?v=aPbJmYCSCgA)

[Nicholas **Negroponte**: 5 predictions, from 1984 | Video on **TED**.com](http://www.ted.com/talks/nicholas_negroponte_in_1984_makes_5_predictions.html)

[**Leah Buechley**: How to "sketch" with electronics | Video on **TED**.com](http://www.ted.com/talks/leah_buechley_how_to_sketch_with_electronics.html)

Paper by Edith Ackermann - [Programming For The Natives: What is it? What’s In It For The Kids?](http://linkedith.kaywa.com/files/Program.CRN.photo-ready.12.pdf) (2012)

[Misconceptions About Logo](http://dailypapert.com/?page_id=353) for Game changers section

## Week 5 - Chapters 9,10 Shaping the Learning Environment

CHAPTER 9 SHAPING THE LEARNING ENVIRONMENT

How to create a learning environment (physical, emotional, and intellectual) that is most conducive to making.

CHAPTER 10 STUDENT LEADERSHIP

The maker movement is an opportunity for students to become leaders and advocates in their school and community.

### Questions:

1. Do you have opportunity to change the learning environment where you work (or volunteer) to support making?
2. Are you planning to create a makerspace, either in a classroom or in a separate space? Please share your plans or questions with the group.
3. The educators of Reggio Emilia call the classroom “the third teacher”. What lesson is your classroom teaching?

### Homework:

Program something in Scratch and share your experience here or in a blog post.

## Week 6 - Chapters 11,12,13 Making It Happen

CHAPTER 11 MAKE YOUR OWN MAKER DAY

Share the fun of making with everyone.

CHAPTER 12 MAKING THE CASE

How to convince others that invention, making, and makerspaces belong in your school.

CHAPTER 13 DO UNTO OURSELVES

How can teachers learn to do and teach things that didn’t exist when they went to school?

The book travels an arc from history, to educational theory, to classroom practice, to new tools/materials, to practical matters, to advocacy. Did some parts of the book resonate more than others? Why do you think this is true?

### Questions:

1. What do you believe will be the most convincing argument for learning through making in your school or organization? Is this the same argument that convinced you originally?
2. Recount a making experience from your childhood.
3. Have you ever experienced open-ended professional development like the one described in Chapter 13 (Constructing Modern Knowledge)? How did it compare with “typical” professional development? Did it work better for you or not?
4. If you created a Scratch program from last week’s homework, please share your masterpiece (and your experience) with the community.

### Homework: Change the world!