

# Critiques of Student-Led Activities in the Classroom

Craig Miller

School of Computing

# Last Spring at the Conference

## Personalized Adage

Your Nemesis

Sometimes you get the bear...  
And sometimes the bear gets you.

```
2 <html>
3 <head>
4 <meta charset="UTF-8">
5 <title>Personalized Adage</title>
6
7 <script>
8 function create()
9 {
10     var nemesis = document.getElementById("nemesisField").value;
11     var message = "Sometimes you get " + nemesis + "... " +
12         "<br>And sometimes " + nemesis + " gets you.";
13
14     document.getElementById("adageElement").innerHTML = message;
15
16 }
17 </script>
18
19 </head>
20
21 <body>
22
23 <h1>Personalized Adage</h1>
```

Why watch someone do a problem rather than work through it? I don't get it.

Craig is locked into the 20th century teaching model. Class needs to be used for discussion not lectures.

Kirschner, Sweller & Clark (2006):

Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching

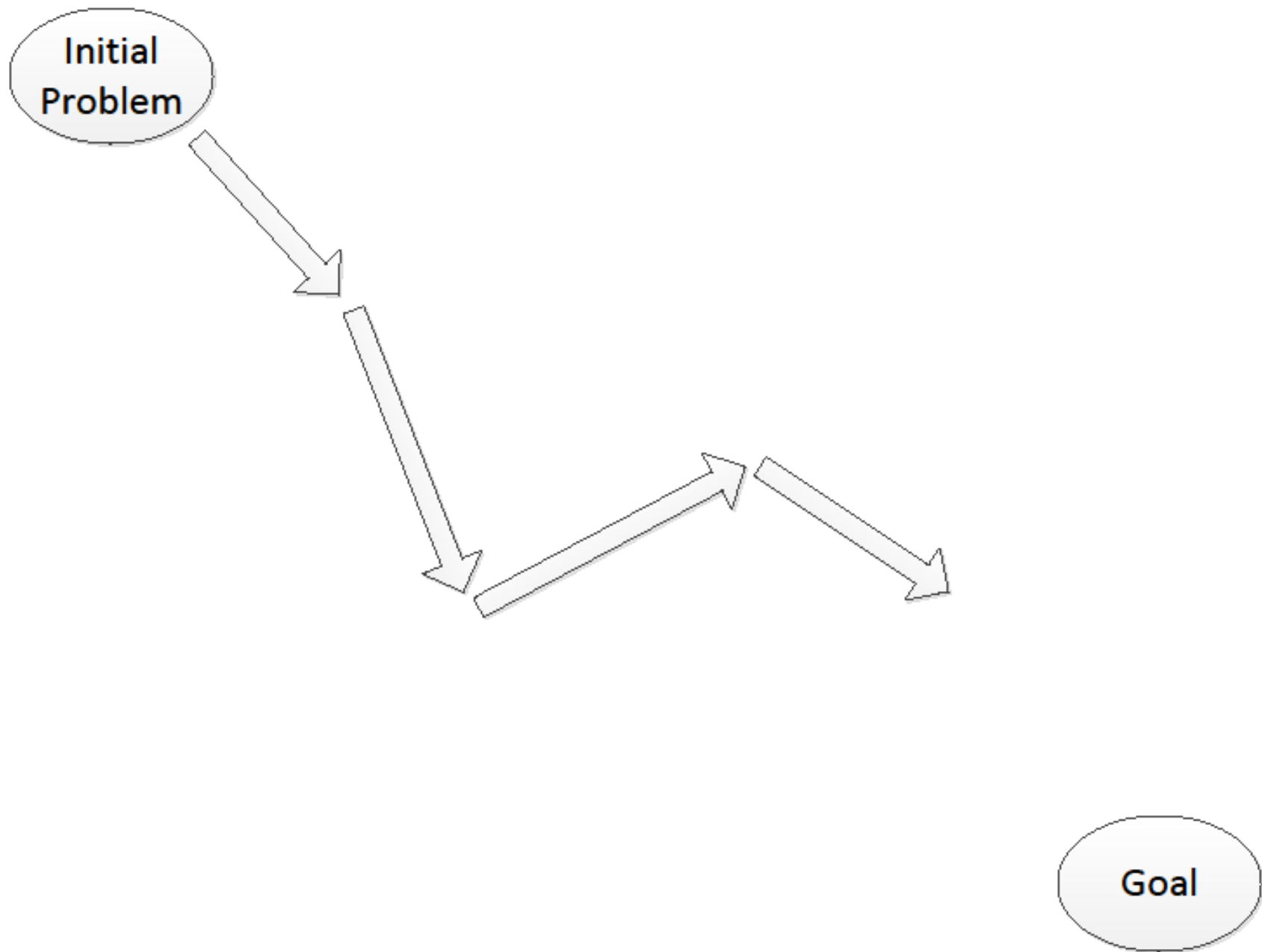
*Educational psychologist, 41(2), 75-86.*

# Key Findings from Kirschner et al.

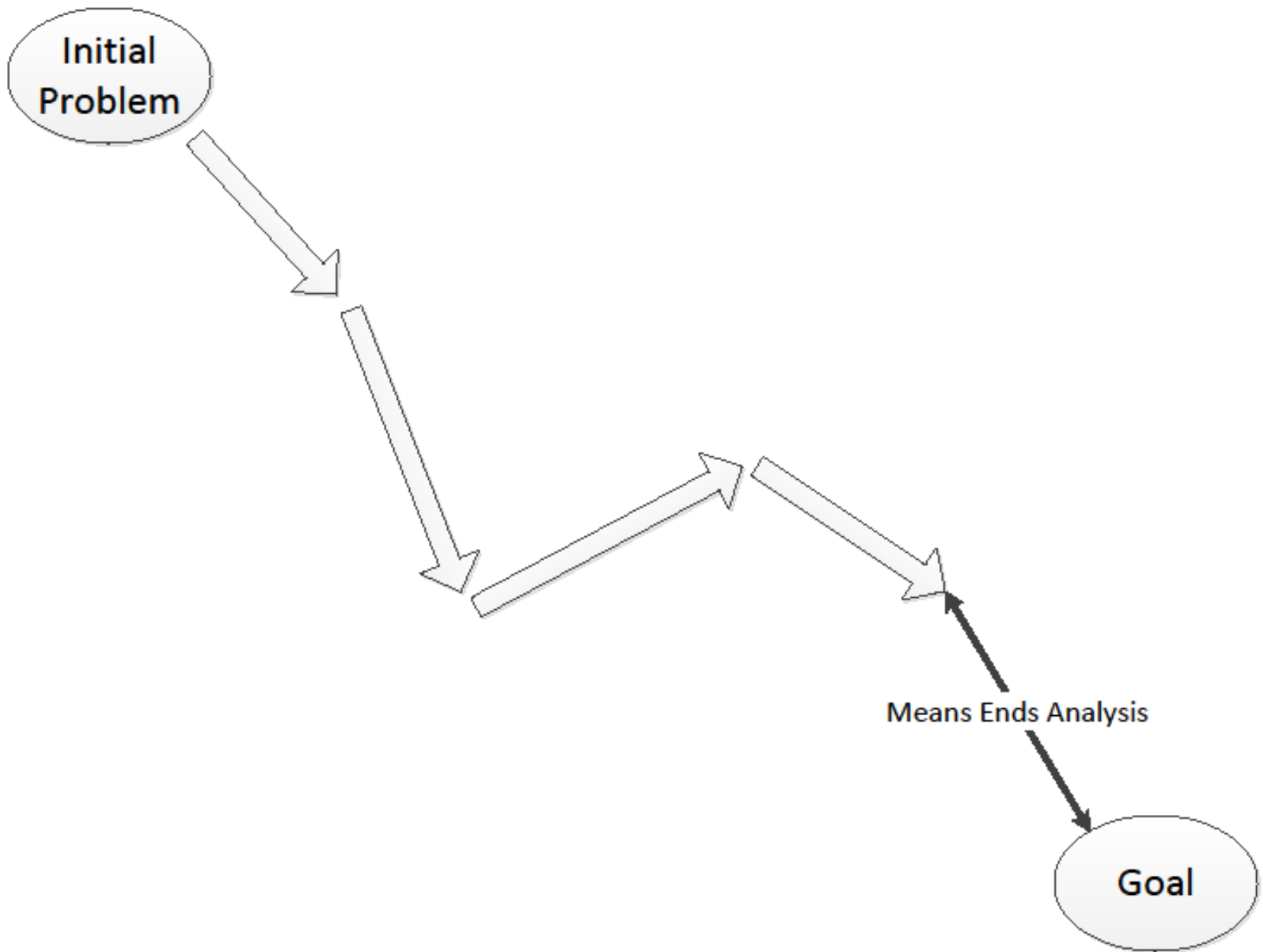
- Compared to problem-solving activities, studying worked examples produces superior learning---even when measured by problem-solving ability
- Supported by controlled studies
- Studies mostly involve physics, math and computer programming, but other disciplines have been studied (e.g. visual literacy, Rourke & Sweller, 2008)

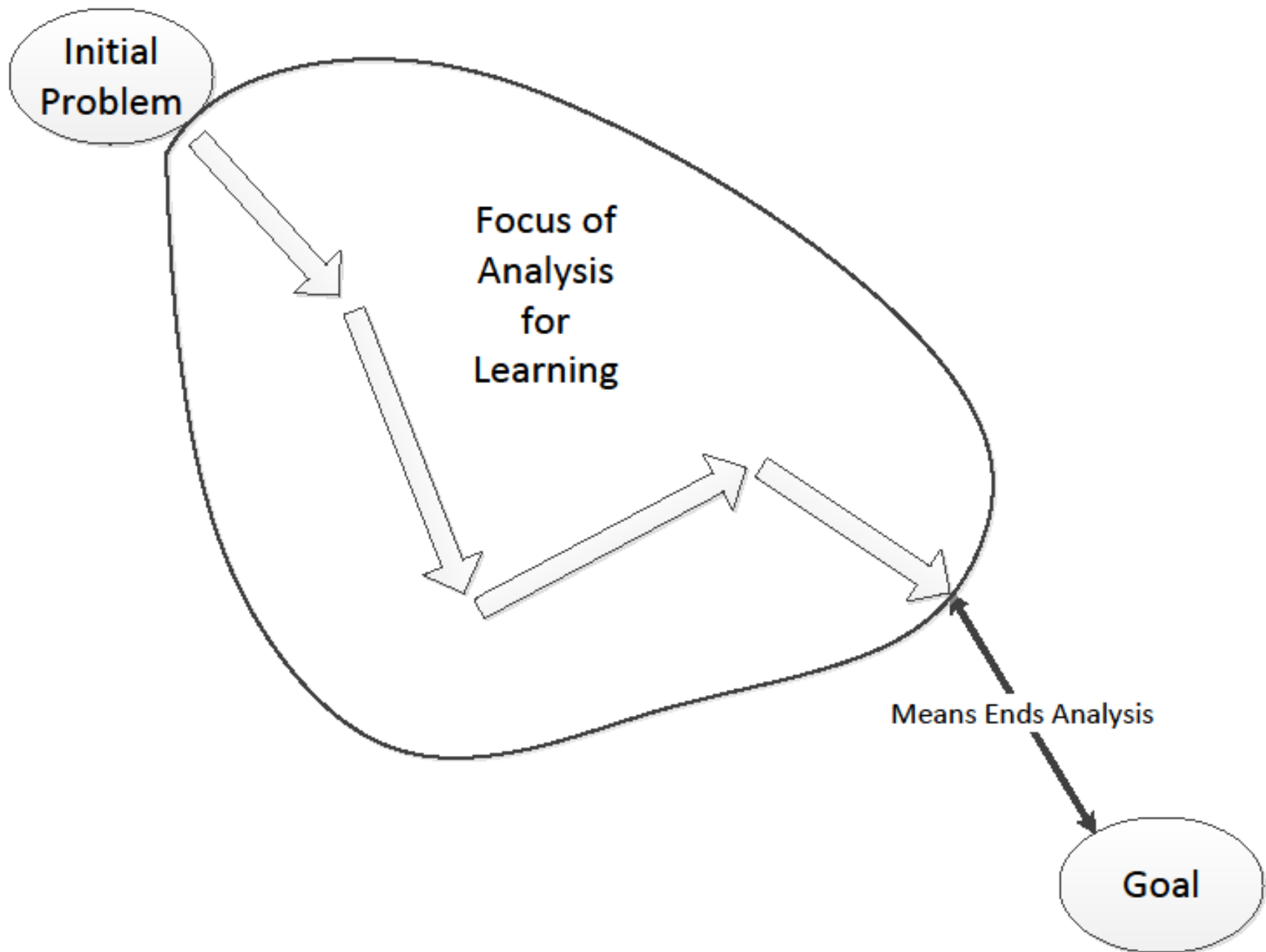
# I'm NOT claiming that

- Constructivism as a theory of learning is wrong (see Clark & Mayer, 2008)
- Problem-solving is not important
- The flipped classroom is a bad idea
- We don't want to engage students in the classroom
- Problem-solving is never a good activity for learning

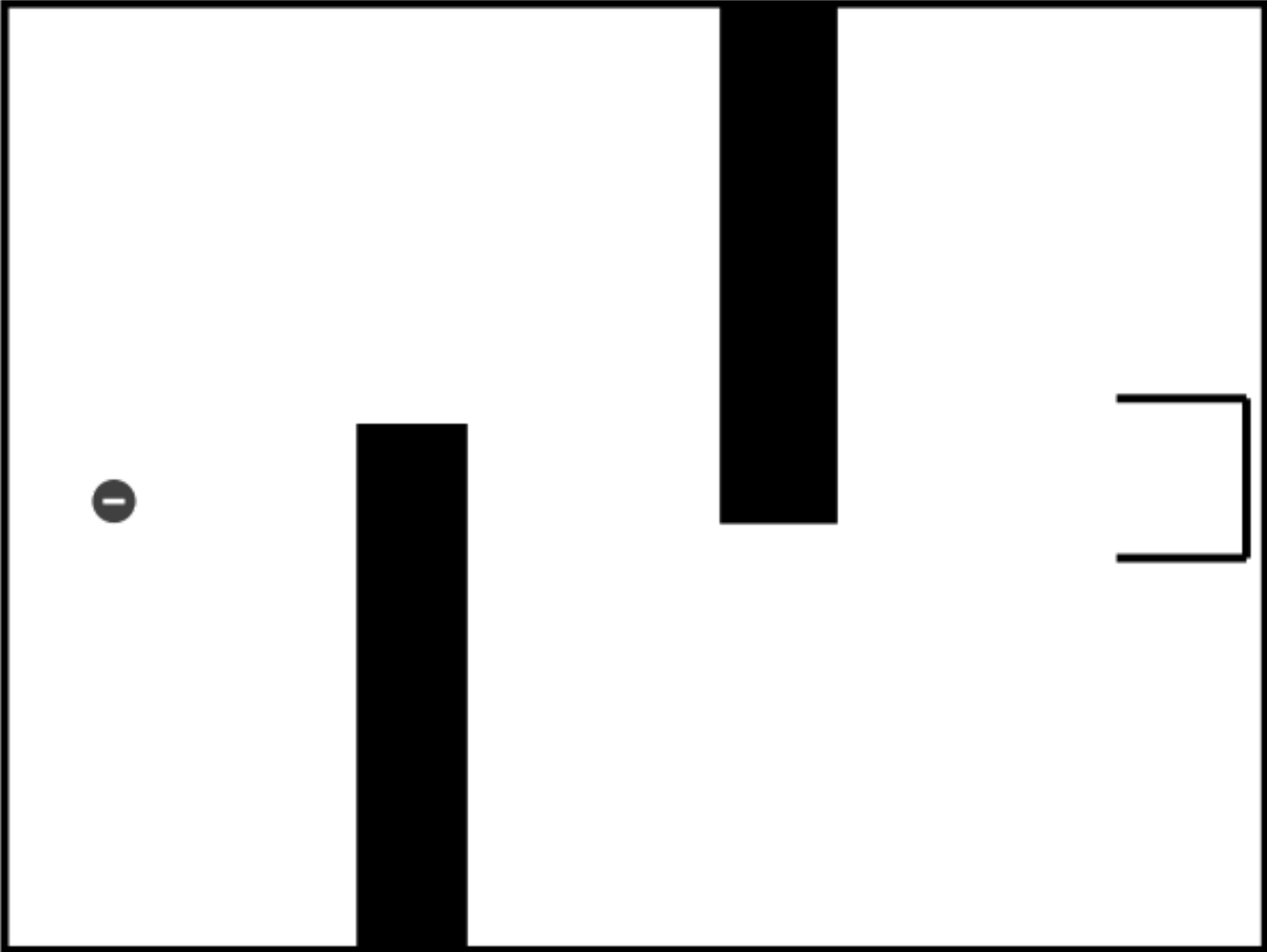


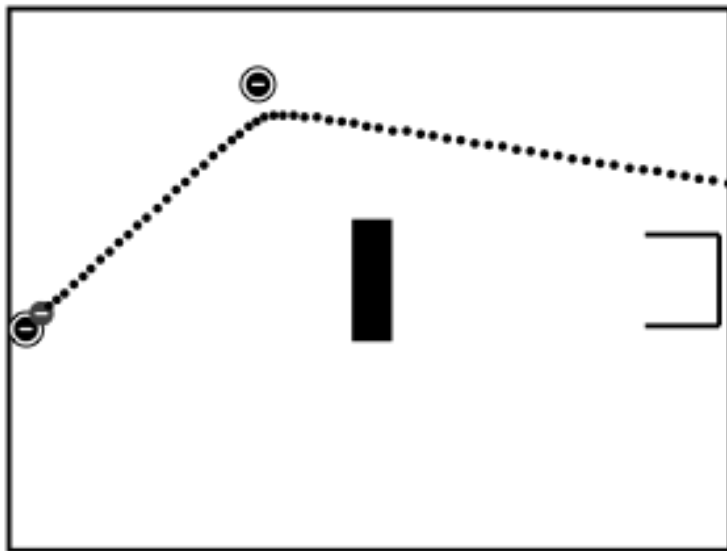




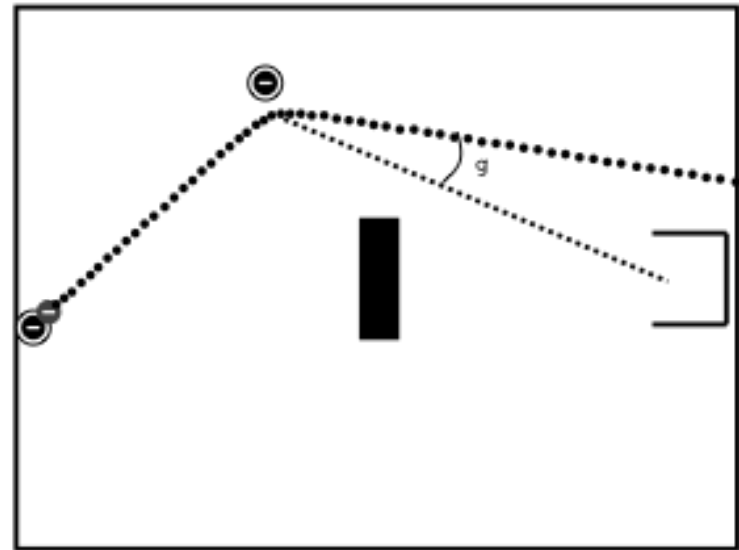


# Electric Field Hockey: Problem-Solving in an Electrostatics Microworld

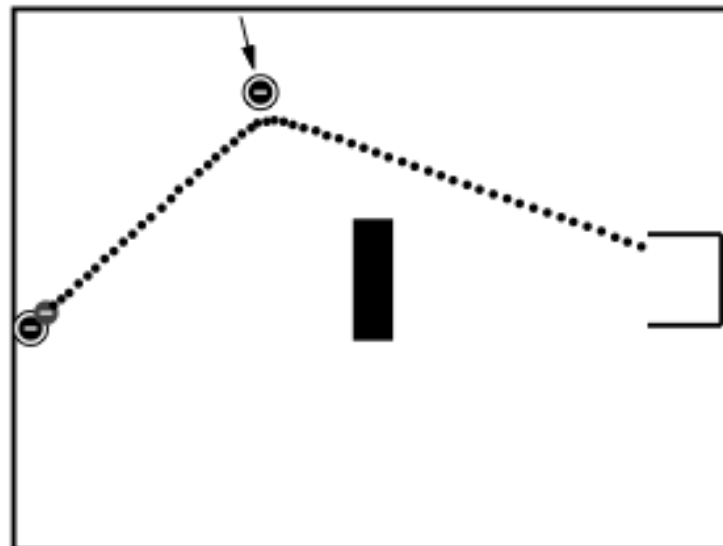




(a) Trajectory missing goal



(b) Noting difference between intended trajectory and resulting trajectory



(c) Moving charge closer for more bend

# Alternatives to Student-Led Problem-Solving

- Study of worked examples
- Instructor-led problem solving
  - Includes live coding (Rubin, 2013)
- Self explanation
  - See Amber Settle's talk this afternoon
- Scaffolded problem-solving
  - Example: provide explicit subgoals

# Role of Problem-Solving

- Often effective for advanced learners
- Provides motivation
- Less studied for non-STEM disciplines
- Run your own study
  - We did! (Miller & Settle, 2011)

# References

- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist, 41*(2), 75-86.
- Rourke, A., & Sweller, J. (2009). The worked-example effect using ill-defined problems: Learning to recognise designers' styles. *Learning and Instruction, 19*(2), 185-199.
- Clark, R. C., & Mayer, R. E. (2008). Learning by viewing versus learning by doing: Evidence-based guidelines for principled learning environments. *Performance Improvement, 47*(9), 5-13.
- Miller, C. S., Lehman, J. F., & Koedinger, K. R. (1999). Goals and learning in microworlds. *Cognitive Science, 23*(3), 305-336.
- Rubin, M. J. (2013). The effectiveness of live-coding to teach introductory programming. In *Proceeding of the 44th ACM Technical Symposium on Computer Science Education* (pp. 651-656). ACM.
- Miller, C. S., & Settle, A. (2011). When practice doesn't make perfect: Effects of task goals on learning computing concepts. *ACM Transactions on Computing Education (TOCE), 11*(4), 22.