Instructional Design is to Teaching as Software Engineering is to Programming

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K.3.2 [**Computer and Information Science Education**]: Computer Science Education

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1. SUMMARY

Attendees of this special session will learn about the educational theory of Instructional Design and how it can benefit their teaching and practice. In particular, the session will cover the popular Dick & Carey model, meant for beginners to Instructional Design. This model helps instructors rigorously define *who* they will teach to, *what* they will teach, *how* they will assess, and (only then) *how* they will teach. The approach is parallel to Software Engineering techniques such as Test-Driven Development, Requirements Engineering, and Iterative Development.

The session will be a blend of presentation, participation, and assessment, recursively serving as an example of an Instructionally Designed lesson. Participants will work in small groups both to foster discussion and to provide learning support. It is our hope that attendees, whether new to teaching or experienced, will adopt or be influenced by the model in order to approach their courses with the same rigor they apply to software development.

2. OBJECTIVE

Instructional Design is the iterative, systematic design of effective Learning Experiences by following a coherent process that gives measurable results. Its distinguished history stretches back into the 1930s [2], but there has been surprisingly few published cases of its usage in Computer Science Education. Most of this research reflects on how Software Engineering techniques can be applied to Instructional Design [3, 4, 6], while much of the remainder approaches the field loosely by focusing on pedagogical tools and tactics [1, 5] rather than holistic, cohesive processes.

Figure 1 gives an overview of the phases of the Dick & Carey Model. Notice that the actual development and testing of instructional materials and strategy is saved for the final phases of the model, rather than the beginning. Instead, instructors begin by analyzing their "users" (the learners) and their instructional goals, then determine concrete objectives and measurements (tests), and finally focus on design and development. Similar to how Software Engineering does not dictate your specific architecture but rather your documentation and testing, Instructional Design promotes documentation and organization over constricting your pedagogy. Instructional Design is compatible with and even benefits from a number of other popular educational theories, including Constructivist Learning, Active Learning, and Collaborative Learning.

This session will be organized as a blend of tutorial and hands-on, small-group exercise. The session is important because it will introduce a new, practical educational theory to attendees who may be completely unfamiliar with it. Instructional Design should resonate with instructors that have an engineering background and yearn for similar structure in their design of learning experiences.

3. OUTLINE

Pre-Test (10 minutes) Attendees will be given a brief, optional "pre-test" to ground them in the material.

Introduction: (10 minutes) Attendees will be given an overview of the Instructional Design model, its history, and its pros and cons.

Case Study: (15 minutes) Attendees will be walked through a real execution of the Instructional Design model and the lessons learned from using it.

Practice Problems: (20 minutes) Attendees will get to apply the model in small groups to solidify their knowledge.

Post-Test: (10 minutes) Attendees will be given a brief, optional "post-test" to help them identify if they learned the material of the session.

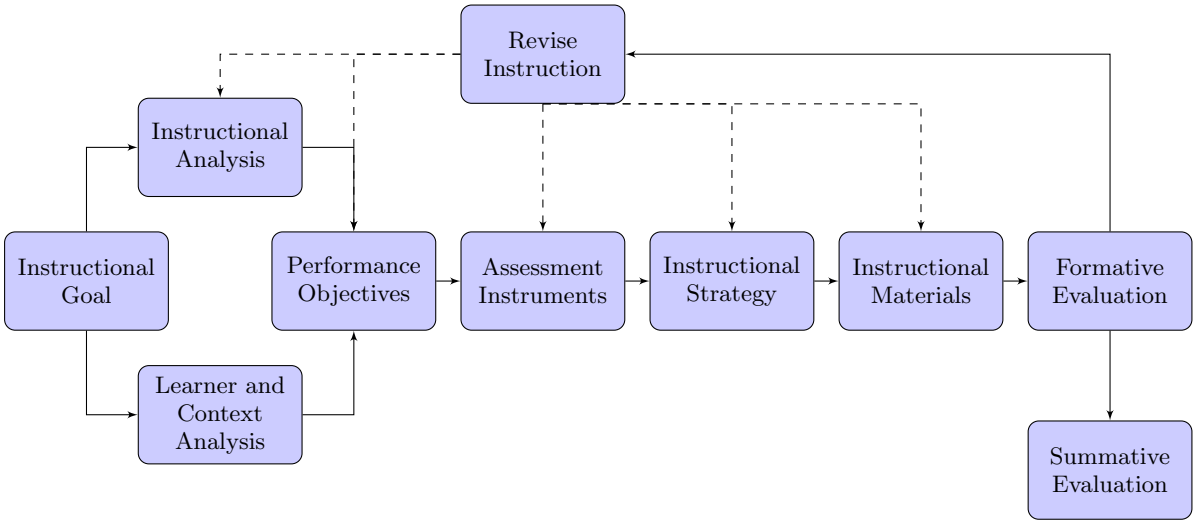

Figure 1: The Dick & Carey Model of Instructional Design

Discussion: (10 minutes) Attendees will discuss how the model could be applied to their own classrooms, and their reaction to this special session.

4. EXPECTATIONS

The expected audience is computer science instructors, although anyone interested in educational theory should find the session useful. No prior experience with Instructional Design is expected. This session will cover an overview of the Dick & Carey model and demonstrate how it can be used in Computer Science classrooms at any grade level (K-12, undergraduate, etc.), any experience level, and any setting. We expect that even many instructors with former experience will benefit from learning this concrete method.

The session will cover how instructors can get more information about the model, to promote long-term transfer of the material. Feedback will be solicited from attendees using a survey, and there will also be a pre- and post- assessment (both meant as a formative evaluation of the materials and to guide attendees' learning).

5. SUITABILITY FOR A SPECIAL SESSION

The presenters believe that this session is particularly suitable as a Special Session rather than a paper or panel because it requires hands-on experience and sufficient time to do so. Although a workshop would be a suitable alternative to this format, we suspect that few attendees will be sufficiently knowledgeable of Instructional Design to be willing to invest money in attending it - although we also suspect that once exposed, instructors will be considerably more interested. The Special Session format allows us to provide the SIGCSE community with a low-stakes introduction to a powerful new technique that could revolutionize the way we design our lessons.

6. REFERENCES

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