Applying the Component Display Theory to the Instructional Development and Design of an Educational Mobile Application

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Introduction

While mobile learning environments have some similar characteristics to computer based and web based systems, there are unique characteristics of mobile learning environments related to usability and functionality that will invariably affect the elements in the learning system. Gedik, Hanci-Karademirci, Kursun, and Cagiltay (2012) identified three categories of issues that are critical in the design of mobile learning: technical and technological issues related to the type and functions of the mobile device; curricular and pedagogical issues related to the purpose and strategies of the instruction; and management issues related to communication between design and development stakeholders. Given these unique characteristics, mobile technologies present an opportunity for scholars and practitioners to extend the application of instructional design theories and models to a mobile learning environment.

The goal of this research-in-progress is to validate and extend the component display theory (CDT), a traditional instructional design (ID) theory. Using a formative research approach (Reigeluth & Frick, 1999), which focuses on improving design theory for instructional practices and processes, the CDT will be used to design a mobile application within the context of a fully online, faculty development workshop. In this paper, initial research and thoughts are offered on using the CDT. Specifically, a summary of the CDT, an example of its application, and initial thoughts from an instructional designer’s perspective on variables that will influence the design of the instruction are presented.

The following three research questions guide this study:

• How can the CDT be used to guide the design and development of instruction within a mobile learning environment?
• What key processes are pertinent to translating ID plans into mobile learning lessons?
• What are the challenges and issues in designing instruction for a mobile learning environment?

Using CDT to Guide the ID Process

The CDT (Merrill, 1994a) is a micro-level theory that prescribes presentational strategies for instruction based on the subject matter content (fact, concept, procedure, and principle) and the expected student performance (remember-general, remember-instance, use, and find). Through prescriptions, the goal of the CDT is to minimize the over and under generalization of information that may increase errors and difficulty in the transference of knowledge to the learner. Subsequently, the CDT prescriptions (1994b) have four parameters to guide the design of instructional strategies:

• Primary presentation: discrete instructional presentation based on two dimensions, content mode (general or instance) and presentation mode (expository or inquisitory)
• PPF content: elements that should be present in the primary presentation for consistency of content
• Secondary presentation: information, such as mnemonics, feedback, and prerequisite information, used in addition to the primary presentation to enhance learning by helping the learner process information or by providing additional context.
• Inter-display relationships: interrelationships between different presentation forms that will affect how learning will occur. The relationships include the difficulty and randomness of presentations as well as learner control in the instructional system.
The parameters offer explicit strategies and identification of instructional components that can make instruction more effective for knowledge transference. As a result, this framework makes the CDT attractive for designing instruction for a mobile learning environment, where the combination of discrete learning objects and learner/facilitator/content interactions is used for instruction in a learner-controlled environment.

**Example of Use**

For educators, applying copyright law and the principle of fair use in a digital learning environment can be complex and confusing. So, for faculty development at a two-campus, community college district, a lesson on copyright and fair use is being designed and will be delivered via a mobile application. The goal of this lesson is to explain the concept and principles of copyright law and how educators can identify and discriminate among various exemptions and limitations including, fair use, Digital Millennium Copyright Act (DMCA), The Technology, Education, and Copyright Harmonization Act (TEACH Act), and public domain.

What follows is a design draft for the first module (Figure 1). The CDT is used to write the workshop objectives, based on the performance objective and subject content, and to identify the relevant instructional prescriptions. Based on the prescription, instructional strategies are developed, including how new information and examples are presented, what types of instructional support tools are needed, the types and quantity of practice and assessment items, and how feedback should be given to the learner. The complete prescription for the first module is presented and the instructional strategy summary identifies how each component is implemented.

**Module Objective:** Learners will define copyright law and identify critical attributes.

**Instructional strategy summary:** Learners are given a contextual situation in which the concept of copyright will be described. The definitions of copyright law as well as the key attributes that differentiate it from other intellectual property right, such as trademark and patents, are given (b). The definition is followed by an example that illustrates the critical attributions for copyright (c). Visual aids will be created to assist learners in remembering attributions (e, f). At least two different practice scenarios that provide the learner opportunities to identify attributes and recognize the definition will be offered (d, l). The practice scenarios will be followed by the correct answer with explanation (g).

**Evaluation:** After a short delay, correctly recall definitions and identify at least 4 attributes of copyright law. (j,k)

**Additional ID notes:** Learners will control the pace and sequence of the presentation through navigational elements.
Initial Thoughts

Through initial work with the CDT, two areas of the model deserve future examination as to how it may affect the design and development of instruction. The first is the element of learner control, which determines whether the learner or the instructor/system makes decisions about the learning. Learner control is part of the inter-display relationship parameter in the CDT and is related to how the student determines the number of primary presentation instances to study, when to receive help, and other strategy decisions (Merrill, 1999a).
In discussing pedagogical affordance provided by mobile learning, Park (2011) adopts a hierarchical structure (Figure 2) of the mobile technologies that connects the formal and informal learning environment for learners. Level 1 focuses on individual learning whereas Level 4 focuses on collaborative learning. The hierarchy illustrates the range of mobile functions that can give learners the ability to adapt or extend the learning components, through various navigations, support aids, and interactions, to accommodate his/her own learning style and preference. For ID practitioners, decisions will need to be made on what types of mobile functions and features will facilitate appropriate control of the content, interactions between formal and informal networks for the learner, and how best to integrate control into the environment.

Figure 2: Mobility hierarchy, sample applications, and technological affordances (Park, 2011)

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<thead>
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<th>Mobility Hierarchy</th>
<th>Sample Applications</th>
<th>Technology Affordances</th>
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| Level 4            | Communication & Collaboration | • Real-time chat  
|                    |                     | • Annotations  
|                    |                     | • SMS (Simple Messaging System)  
|                    |                     | • Wireless email  
| Level 3            | Capturing & Integrating Data | • Network database  
|                    |                     | • Data collection/synthesis  
|                    |                     | • Mobile library  
| Level 2            | Flexible Physical Access | • Local database  
|                    |                     | • Interactive prompting  
|                    |                     | • Just-in-time instruction  
| Level 1            | Productivity        | • Calendars  
|                    |                     | • Scheduling  
|                    |                     | • Contact information  
|                    |                     | • Grading  

The second element to further examine is the student, environmental, and task (S.E.T.) attributes that may put conditional controls on how prescription parameters are implemented. Based on the prescriptions, very little of the CDT model has been made conditional based on the S.E.T attributes (Merrill, 1994b). Mobile technology offers self-regulated learning opportunities, and the integration of informal and formal learning experiences. Explicit conditional controls based on S.E.T attributes may provide additional ways to support learners in a more personalized learning environment, specifically for the practice presentations, help, feedback, and learner control parameter elements. These two areas of learner control and S.E.T. attributes will be future examined as the instruction is developed, with expectations that the CDT model can be adapted to take advantage of mobile affordances and offer practitioners a framework to design and develop instruction for mobile learning environments.

References


