Integrating HCI into IDT: Charting the Human Computer Interaction Competencies Necessary for Instructional Media Production Coursework

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Abstract

A report on the efforts made to describe the range of human-computer interaction skills necessary to complete a program of study in Instructional Design Technology. Educators responsible for instructional media production courses have not yet articulated which among the wide range of possible interactions students must master for instructional media production purposes. A hierarchy of human-computer interactions is introduced. The method and results of a preliminary study of 12 student projects are described.

Introduction

This is a report on preliminary efforts made to determine which among the multitude of human-computer interactions should be emphasized as part of course of study in Instructional Design Technology. The purpose of this report is to inform those instructors and policy makers responsible for the design and delivery of courses in instructional media production as part of a program of study in Instructional Design and Technology. The authors sought to determine which aspects of human-computer interaction and design are critically important to include in a course of study that prepares one to take on the responsibilities of a professional instructional designer. There is currently very little written or reported on this topic. The authors suspect that many, if not all, programs of study in Instructional Design Technology rely solely on the judgment of individual faculty members to decide what types of human-computer interactions should be mastered by students within their individual programs.

A review of graduate programs in Educational Technology, Instructional Design, Instructional Systems, or Instructional Technology offered by accredited post-secondary institutions in the United States (including Florida State University, Indiana University, Pennsylvania State University, San Diego State University, Syracuse University, East Carolina University, California State University, Fullerton, University of Colorado at Denver and University of Georgia), referred to collectively as Instructional Design/Technology (IDT) programs hereafter, revealed that all contained as part of their program of study at least one instructional media production course requiring the use of some type of computer-based authoring program (e.g. *Director, Flash, Toolbook, HyperStudio, Authorware*). A simultaneously conducted review of jobs requiring a degree in IDT (jobs posted online at AECT, *The Chronicle of Higher Education and* Jobsearchsite.com) indicates that the majority of these positions specify the need for skill in computer based training (CBT), thus justifying the program requirements of the schools reviewed.

Every IDT program requires the development or demonstration of some skill with authoring software in order to create at least a working model of a computer-based, instructional interaction, and most jobs advertised call for experience in this area. None of the IDT programs of study reviewed currently require that students demonstrate competence in computer programming (using languages such as C++, or Java) or network administration, nor do the vast majority of IDT positions advertised require these advanced computing skills. It can therefore be inferred that the discipline of IDT does not require advanced level skills with computing machinery (e.g. "hardcore" programming or network administration certification), but it does call for some ability to create human-computer interactions at a level that is more sophisticated than a common *PowerPoint* presentation. The standard competencies articulated by the International Board of Standards for Training, Performance and Instruction (IBSTPI) (Richey, Fields, and Foxon, 2001) reflect this as well. The essential competencies that are specifically addressed by requiring students to work with computer-based authoring programs include:

> 3. Update and improve one's knowledge, skills and attitudes pertaining to instructional design and related fields.
>
> b. Acquire and apply new technology skills to instructional design practice.
>
> 11. Analyze the characteristics of existing and emerging technologies and their use in an instructional environment.

a. Specify the capabilities of existing and emerging technologies to enhance motivation, visualization, interaction, simulation, and individualization.

c. Assess the benefits of existing and emerging technologies.

It appears that IDT students require more than the ability to control human-computer interactions such as conducting slideshow-type presentations but less than the ability to write computer software using a programming language. Knowing that these are the far ends of the spectrum, the question becomes, "What lies within the range between these extremes?" Knowing the answer to this would pave that way for an answer to the question, "What human-computer interactions should professors of Instructional Design/Technology (IDT) expect students to be able to control?" In other words, regardless of the authoring tool required or recommended, what elements of human-computer interaction must an IDT professional have control over in order to do his/her job well?

Those responsible for teaching instructional media production courses within IDT programs have not yet as a group articulated which among the wide range of possible interactions are necessary to command in order to effectively produce instructional media. Furthermore, lacking a description of the range of possible interactions, one cannot describe what is considered *beginner*, *intermediate* or *advanced* control of these tools. In order to ensure consistency and quality within programs of study in IDT, a more complete articulation of the HCI capabilities important to members of the field is needed.

Defining Human-Computer Interaction (HCI)

One problem encountered when attempting to describe the interactions necessary to complete an instructional design project is the nebulous nature of HCI as a field of study. According to the Association for Computing Machinery's special interest group on Computer-Human Interaction (ACM SIGCHI, 1996):

> "There is currently no agreed upon definition of the range of topics which form the area of human-computer interaction. Yet we need a characterization of the field if we are to derive and develop educational materials for it. Therefore we offer a working definition that at least permits us to get down to the practical work of deciding what is to be taught:
>
> Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.
>
> From a computer science perspective, the focus is on interaction and specifically on interaction between one or more humans and one or more computational machines. The classical situation that comes to mind is a person using an interactive graphics program on a workstation. But it is clear that varying what is meant by interaction, human, and machine leads to a rich space of possible topics..."

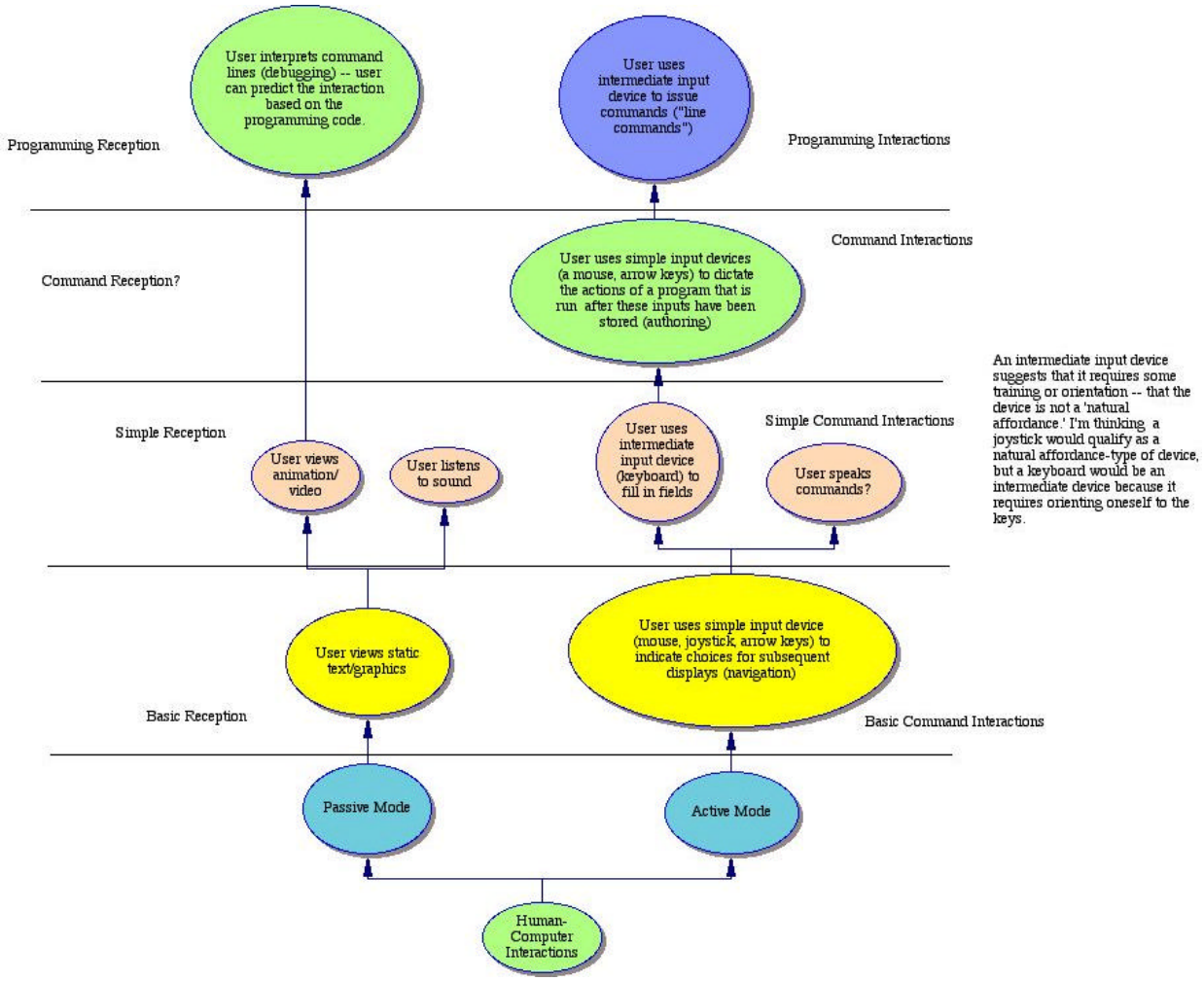
For purposes of current needs within the field of IDT, HCI study can be limited to the interaction between one or more humans and one or more *standard* computers. A standard computer is defined as a computing machine that accepts input via the popular devices of mouse, keyboard, or touch-screen/stylus, and outputs information via visual display (monitor or LCD) and audio (speakers or earphones).

Method

Very little has been written on determining which human-computer interactions should be emphasized for purposes of instructional media production and HCI in general is a nebulous area. Even with limiting our attention to standard computer hardware, we found ourselves needing to experiment with ways of articulating HCI in general. We also needed to find a way to compare HCI elements in general to those elements that are most often used for student-created instructional media projects.

Step One: Articulating the range of human-computer interactions.

To begin to address the questions posed, the authors discussed a series of HCI interactions, describing the type of interaction and suggesting the level of computing sophistication necessary to complete the interaction. The two modes, "active" (or "command") and "passive" (or "reception") are divided into four hierarchical categories: "basic," "simple," "advanced" and "programming." One of the authors devised a graphic representation of the possible levels of human-computer interaction (Figure 1).



The idea of dual modes (passive and active) and four general levels (basic, simple, command and programming) is a first attempt to articulate the variety of human-computer interactions that are possible. They are a "talking point" through which the authors gained a common language between themselves about which HCI interactions are necessary to command for effective instructional media production.

Perhaps the most useful aspect of the modes and levels idea is that it begins to form the foundation for what may be considered *beginner, intermediate* or *advanced* control of human-computer interactions.

Step Two: Examining the human-computer interactions applied to course projects.

The next step in answering the question, "What human-computer interactions should professors of Instructional Design/Technology (IDT) expect students to be able to control?," was to examine a variety of projects completed by students in instructional media production courses. The authors examined twelve projects created for a variety of courses (all taught by the authors). The projects were computer-based instructional media produced within the last three years. The projects were created using computer-based "authoring tools," including Authorware, Director and Flash. A chart was created using the two broad categories mechanics and design. Within each of the two broad categories a series of sub-categories and the specific examples within these sub-categories were described (see Table 1). Each of the projects was then scrutinized to determine if they contained examples of the human-computer interactions listed. It is important to add that we use the word "interactions" because it is part of the common parlance of those who study HCI; we actually use it as a synonym for the phrase, *design intention* or *design consideration*. In many cases, there are no specific interactions that can be observed. For example, "Text" can be observed (text is either present or it is not) but, strictly speaking, it is not an interaction.

The authors then selected 12 examples of student created, computer-based instructional media developed for courses that emphasize instructional media production. Each was examined to determine which specific examples of the human-computer interactions listed in Figure 2 could be directly observed in the student project (during this process, a few specific human-computer interactions were added to the initial list because examination of the project spurred further consideration between the authors).

A simple tally of the instances when specific human-computer interactions were observed revealed that a few interactions were ubiquitous (occurring in all projects) and some were common (occurring 9 times or more), while others could be observed less frequently, and a few were not observed at all.

Categories	Sub-Categories	Specific, Observable Instances	Number of Instances
Mechanics	**Still Graphics**		
		Images	**12**
		Text	**12**
	Animation		
		Animate d Text	**5**
		Animated Images	
		Animated Buttons (rollovers)	**3**
		Video Sequence	**4**
		Screen Changes (transitions)	
	Buttons		
		Overt Buttons ('standard' buttons)	**10**
		Images that Act as Buttons	**8**
	Fields		
		Input Fields	**6**
		Output Fields	**8**
	Sound		
		As Part of Video Sequence	**3**
		Sequenced with Animated Text or Graphics	**3**
		Sound effects	**4**
		Narration	
		Background Music	**1**
	Navigation		
		Linear Navigation	**9**
		Non-Linear Navigation	**4**
		Menus	
		"Next" and "Back" Buttons	**6**
	Variables		
		Local Variables	**8**
		Global Variables	**4**
	Math Functions		
		Basic Math Functions	**3**
	Writing function		
		Writing function	**1**
	Review Function		
		Review function	**1**
	If-Then Situations		

		Triggering a dialogue box ("you didn't fill in your name")	**5**
		Allowing a user to continue (if the user answers correctly, they may go on)	**7**
Design	**Testing**		
		Multiple Choice Questions	**6**
		Feedback (correct and wrong) Per Question	**9**
		Feedback for Completed Test (Test Score)	**5**
		Short-answer	**5**
		Drag/Drop	**2**
	Graphic Design		
		Consistent "Look and Feel"	**9**
		Age Appropriate Font Size	**10**
		Highlight keywords	**2**
		Used for stories	**3**
	Writing		
		Grammar, Spelling, Puncuation (high quality)	**6**
		Well-Crafted Text Content (well-written text)	**8**

Table 1: *The categories, sub-categories and specific human-computer interactions looked for in the student projects examined, along with the number of times each instance was observed.*

Listing these instances in order of the number of times they were observed (Table 2) begins to reveal a sense of which human-computer interactions are critically important in a student instructional media production project and which are less so.

HCI component	Number of Instances
Images	12
Text	12
Overt Buttons ('standard' buttons)	10
Age Appropriate Font Size	10
Linear Navigation	9
Feedback (correct and wrong) Per Question	9
Consistent "Look and Feel"	9
Images that Act as Buttons	8
Output Fields	8
Local Variables	8
Well-Crafted Text Content (well-written text)	8
Allowing a user to continue (if the user answers correctly, they may go on)	7
Input Fields	6
"Next" and "Back" Buttons	6

Multiple Choice Questions	6
Grammar, Spelling, Puncuation (high quality)	6
Animated Text	5
Triggering a dialogue box ("you didn't fill in your name")	5
Feedback for Completed Test (Test Score)	5
Short-answer	5
Video Sequence	4
Sound effects	4
Non-Linear Navigation	4
Global Variables	4
Animated Buttons (rollovers)	3
As Part of Video Sequence	3
Sequenced with Animated Text or Graphics	3
Basic Math Functions	3
Used for stories	3
Drag/Drop	2
Highlight keywords	2
Background Music	1
Writing function	1
Review function	1
Animated Images	0
Screen Changes (transitions)	0
Menus	0
Narration	0

Table 2: *Numbers of instances of each HCI component in the 12 projects examined*

Limitations

Although we are intrigued by the findings of this preliminary study, it must be constantly borne in mind that this is indeed only a preliminary study. While the projects examined represented both a wide range of student achievement and a range of varying content areas (from kindergarten activities to corporate training), we only examined 12 projects in all (a very small number considering the universe of projects created for such courses worldwide).

Also, for the sake of convenience, we only examined projects for which the authors served as course instructor (7 of the projects were created for one author's courses; 5 of the projects were created for the other author's courses). To reach any conclusions that might be applied to all Instructional Design Technology programs, we would have to expand the examination to projects created for a great many other instructors in similar programs.

Discussion

The modes and levels of human-computer interaction presented in this paper are intended only to reflect the authors' initial thinking on the subject. While we believe it to be a reasonable starting point for a discussion, it is only that at this time. Like *Bloom's Taxonomy of Educational Objectives* (1956), this organization of HCI elements is meant to spur further discussion. Unlike Bloom's Taxonomy, this is not yet a popular view of the HCI elements. It requires the feedback from many more experts in the field before it can be modified to a point that allows members of the community to generally agree upon its usefulness.

To continue to discuss what the next steps might be in our study, we feel it is important to examine a great many more projects. We are considering the merits of applying a more specific statistical analysis to the results of that examination (e.g. a factor analysis might prove enlightening).

Perhaps the judgment of individual faculty members sophisticated in current advanced technologies may be combined with information about those aspects of HCI that are important to their colleagues in a variety of well-respected programs. There may be some merit to the creation of a set of standards for human-computer interaction skills as they are applied to instructional media production. Even if the creation of standards is *not* the answer, expanded analysis of which HCI considerations merit the greatest attention in an instructional media production course seems prudent at this time.

Conclusions

The examination of the 12 student projects using the list of HCI categories, sub-categories and specific instances suggests that all computer-based instructional media projects include some combination of images and text. The second most important HCI considerations for such projects include the use of overt buttons, control of the font size, a linear navigation component, feedback for questions posed and a consistent look-and-feel. These HCI considerations might well form the basis for what is considered *beginner*-level control of computer-based instructional media.

Also important, but to a lesser degree, are HCI considerations that include: images that act as buttons, output fields, the control of local variables, and well-written text. These, combined with the beginner-level HIC considerations, might form the basis for *intermediate* control of computer-based instructional media.

Those HCI considerations that occur in half or less of the sample population might be considered "extra" or "embellishment" or "optional" considerations that are applied if the context of the instruction demands them. They might not be considered essential elements that all novice instructional media producers would have to have control over, and their presence in a project (along with the HCI considerations that comprise intermediate control) might indicate *advanced* control of computer-based instructional media.

Regardless of whether the label of *beginner, intermediate* or *advanced* is applied to specific instances of HCI, the very fact that certain HCI considerations are observed in many or all of the projects examined suggests that learning to control these HCI considerations should be a part of any course of study in Instructional Design Technology.

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