

Instructional Design and Development Utilizing Technology: A Student Perspective

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Abstract—The sequence Analyze, Design, Develop, Implement, and Evaluate (ADDIE) provides a powerful methodology for designing computer-based educational materials. Helping students to understand this design process sequence may be achieved by providing them with direct, guided experience. This article examines such help and guidance and the overall learning process from a student's personal experience.

Keywords—ADDIE, education, instructional design, web design.

THE following narrative is a student's view of the processes involved in learning the essential procedures of designing instruction with an emphasis on the production of instructional media. The student is the first author, currently completing Walden University's Ph.D. program in Educational Technology. The narrative was validated by the second author, who served as the instructor for the course in question. For purposes of clarity, the narrative is expressed in the first person who in all cases refers to the first author.

I. INTRODUCTION

During the Winter 2008 Quarter at Walden University, I participated in the Instructional Design and Development Utilizing Technology course designed and instructed by Dr. Abbie Brown. The course, designed and instructed by a professor of instructional design, guides students through a full instructional design cycle including pre-production and planning, needs, task, and learner analysis, developing goals and objectives, designing instruction, media production, usability testing, and both formative and summative evaluation. Each student developed, produced, and evaluated his or her own instructional web site as well as discussing the design process with and supporting classmates. Through the course, we were each given direct experience with the instructional design and development process as well as receiving instruction in the theories and models behind the process.

From the student perspective in this course, I would

describe the learning experience as both transforming and practically applicable. The experience was transforming in that my thinking about the design and development process was significantly altered during the course. The experience was practically applicable in that I completed the course both with a usable instructional product and with the ability and confidence to apply the process independently to produce other web based instructional products.

This paper describes the Instructional Design and Development Utilizing Technology course and my transformation as a learner in the course. Each step in the design process is described along with my personal experiences as a student learning and implementing each step. Although there is a large body of work describing the design and development process for instructional materials for the web, there is limited research regarding how this process may be effectively taught [1]–[4]. Previous research on the instruction and learning of web based instructional design and development has focused on methods of instruction and on the overall change in student attitudes and ideas [5], [6]. This paper offers a unique view of the process of learning to design and develop web based instructional materials as it articulates the process by which a student's attitude changes and student's ideas are constructed.

II. LEARNING AND IMPLEMENTING EACH DESIGN STEP

Unlike an established, professional instructional designer, a student faces the challenge of having to both apprehend and implement each step of the instructional design process involved in completing course assignments.

A. Pre-Production and Planning

During the pre-production and planning stage, we were introduced to a number of instructional design models including the general Analyze, Design, Develop, Implement, Evaluate (ADDIE) design model which we would be implementing in class [7], [8]. To begin our project, we were asked to draft a design proposal and to describe what approach we would take with the ADDIE design process. This proposal included both a project description, a production schedule to meet a deadline eight weeks away, and a list of resources needed for the production process. Through the proposal process, we explored design models and approaches as well as the planning process.

I felt very confident when I posted to the classroom discussion forum my plan to create a Web site "integrating

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materials science and band theory approaches to describing metals, insulators, and semiconductors [9]" and said that I would make a basic web site in the following three to four weeks and then using the other four weeks to "try to add" some interactive elements to the site. I had experience getting a web site created and posted which was a concern for some of my classmates, and I was working with subject matter in which I considered myself an expert. I believed at that point that the design, develop, and implement sequence would be easy with that experience and expertise.

Then, the instructor and others started discussing scope and proposal specifics in the discussion, and my rather broad plan, in which I was so confident, was treated very critically. At first, I rebelled a bit. I tried the tactics of proposing the same thing in a slightly different way and suggesting that maybe people just did not understand my idea. However, I found myself giving the same types of constructive criticism to my classmates and noticed that almost everyone was needing to reevaluate the scope of their project to develop a proposal for a product which could be analyzed, designed, developed implemented, and evaluated during the limited amount of time available in the course. I stepped back at this point and thought critically about my own proposal, and I found that the criticism I received was merited. I had described a general subject area of interest not a specific learning product. First, I wrote down what series of lessons were necessary to learn about conductors, semiconductors, and insulators. Then, I picked one of those lessons, classifying materials as conductors, semiconductors, and insulators based on their electrical characteristics. Suddenly, I had very specific ideas for what the web based instructional product would look like rather than just a general topic.

This process of narrowing the scope of projects to a proposal for a specific instructional product that could be produced within the class schedule was an illuminative learning experience. I, and many of my classmates, began with the best of intentions but with broad ideas that did not map to specific, producible products. This narrowing and specification of the instructional design problem is essential for being able to begin the production process [10]. Without this guided experience through the pre-production and planning process, I and others would likely have floundered in the later stages of production because of lack of direction towards creating a specific instructional product. The narrowing and specification process made the design task achievable.

B. Needs, Task, and Learner Analysis

After pre-production and planning, the first step in the ADDIE model is analysis. For this analysis, the needs, task, and learner approach was introduced [7], [10]. Needs analysis looks at the instructional goal or desired change and identifies what instructional problem should be addressed. Task analysis looks at what instructional sequence or series of learner experiences will address the instructional problem. Learner analysis situates this sequence of experiences for a specific

group of learners. The analysis allows instructional product specifications to be set.

In practice, the needs analysis really took place in the pre-production narrowing and specification process before I thought of it as an analysis step. I started with a concept map for circuits and picked properties of conductors, semiconductors, and insulators as an essential node where an instructional need existed. Then, through the narrowing and specification process, my specific instructional goal of classifying materials as conductors, semiconductors, or insulators was identified and I proposed an instructional intervention, a sorting game, to meet this goal. This needs analysis was less formal than standard, accepted approaches, but the results were similar as a specific instructional problem and proposed solution were identified [7]. As a student focused on learning and implementing the overall design process, I felt this informal process worked fine, but a more formal approach to needs analysis would be necessary for professional instructional design work.

The task and learner analysis proceeded iteratively. I broke my instructional intervention, the sorting activity, down into a series of sub-tasks or skills and then identified which of those my learners, average late middle school or early high school students, would already be capable of and which would need to be taught based on standards and the Project 2061 atlas [11]. Then, I broke down each of the tasks that needed to be taught into a series of specific actions a learner would take, and I again analyzed which of those actions would need to be facilitated for my learners relying heavily on input from discussions with representative learners. This was a much more formal process than the needs analysis conducted and closely followed the analysis steps described by Jonassen, Tessmer, and Hannum [12].

Like the narrowing of scope, which informally mirrored the needs analysis, the task and learner analysis was a very illuminating learning experience. At first, I thought only about the cognitive tasks related to understanding the subject matter. After learning more about the analysis process and discussing the process with my colleagues in class, I realized that physical tasks for accessing and completing the instruction are highly important especially in a highly technological environment [7]. The analysis steps turned an interest in designing materials for a general content area into a plan with exact product specifications. Learning and performing these steps was essential to success in learning and implementing the design process.

C. Instructional Design

With the needs, task, and learner analysis resulting in specific product specifications, the instructional design process was half completed before we formally moved from the analysis to the design step. The design step includes developing instructional goals and objectives and organizing instruction [7]. The needs analysis already looked at instructional goals and objectives, and the task and learner analysis looked at general scope and sequence for organizing

the instruction intervention. In this step, these needed to be explicit. Then, other aspects of the design step had to be considered. Notably, designing learner assessment and integrating learner feedback during instruction [7]. At the design step, I recognized that many parts of the step were already completed and rushed ahead to the development step. I had to return to the step later to add the summative assessment component; so, that component was not fully integrated in the final product. In discussion, others showed evidence of a similar error as many people described adding assessment during the evaluation step. Those who had more critically thought through the assessment aspect of design at this earlier stage were more successful at the evaluation step. The design step helps to ensure an integrated product meeting all the design specifications and including assessment and feedback, and meeting other learner needs.

D. Web Page Media Development

Though many of us expected the development or production step where we created the instructional materials to be the hardest part of the process, it actually went very smoothly for me and for most of my colleagues. Early discussions before the production step included concerns about what program to use for producing the web pages, what hosting space to use for the web pages, and how to upload to that space. Later discussions during the production step included some reports of problems with html formatting or issues with uploading web pages, but these were minimal compared to the level of anxiety about production beforehand. Although I was already confident with html, I did experience this process of anxiety followed by success which made the previous anxiety seem foolish and unnecessary. My instructional intervention required an interactive sorting activity. I chose Flash to design the activity and was very nervous about producing it. However, with the help of some tutorials and templates, I was able to complete production of the activity reasonably easily [13]. With a design in place which considered needs, tasks, and learners, the production process proceeded quickly and effectively. I was surprised by how effectively the planning, analysis, and design steps provided preparation for the development step. The ease of development demonstrated the value of following the ADDIE process.

E. Usability Testing and Formative Assessment

Many of my colleagues found usability testing and formative assessment to be one of the most rewarding aspects of the development process as this was when they had the opportunity to see their own students work with and benefit from the materials they designed [9]. I, however, was curtailed somewhat at this step because my product was for the high school level where I taught previously rather than for the graduate masters level at which I am teaching currently and because I am living in a country where primary instruction is not in the language I used for the product. Unlike the majority of my colleagues, I was not able to directly observe learners

using my product, an essential aspect of usability testing and formative assessment in the implement and evaluate phases of the ADDIE process [7]. Instead, one of my colleagues in the course who was teaching science at the high school level did these direct observations for me and reported her ideas. My largest change was separating a set of content which required extensive scrolling into two separate pages. My colleagues described similar changes to design structure as well as minor changes to design content when aspects where learning could be improved were noted [9].

Even with these challenges in implementing the usability testing and formative assessment step for my product, I still felt that this process of trying it out and seeing how it worked for learners was very natural. The usability testing and formative assessment step closely matches what I have done regularly as a classroom teacher. I will often revise a lesson as a class proceeds or between classes in order to better meet learner needs, and this step proceeded in a similarly practical manner. My colleagues who also had classroom experience described a similar degree of comfort with this step and with making simple changes to improve the product. It would be interesting to see whether or not the usability testing and formative assessment process also feels natural to educational software designers who do not have classroom teaching experience.

F. Summative Assessment

Unlike usability testing and formative assessment which proceeded very naturally and easily, the summative assessment was much more difficult to implement and to apply the results from to the product. During this step, it became evident that I should have had a summative assessment plan developed in parallel to the design process rather than trying to add an evaluation at the end. In a future design, I would follow a full summative assessment process like that described by Smith and Ragan or by Morrison, Ross, and Kemp [9]. However, as with implementing the pre-production and planning process and the instructional design step, I understand how to proceed with the summative assessment in a more meaningful manner only after the in-class design experience.

For this design experience, I added an assessment at the end which addressed reactions, learning, transfer, and results as described by Kirkpatrick, but I did not re-design and implement the assessment in a manner consistent with and integrated with my product design [9]. The results I received gave a very basic idea of the efficacy of my product but did not provide insight into improving the product or into the specific strengths and weaknesses of the product. Comments in the course discussion indicated that some of my colleagues also found the summative assessment process difficult and unproductive largely due to lack of planning; however, others who had more purposefully integrated summative assessment were able to use the results productively. Those who were better able to utilize the summative assessment described the development and implementation as a challenge in

comparison to the easier usability testing and formative assessment [9].

III. CONCLUSION AND DISCUSSION OF THE OVERALL STUDENT PERSPECTIVE

Of the numerous insights that may be derived from the student design experience, one stands out: understanding the design sequence for creating computer-based instructional materials requires experiencing that design sequence. Despite completing readings, I did not have a full understanding of the design sequence and ADDIE process until experiencing it. I did not even have a perspective from which I could identify that lack of understanding and proceed appropriately to correct it. After experiencing and being guided through the process, I am now able to identify specific areas such as increasing the design media with which I am proficient and integration of summative assessment in design where I would like to further my knowledge and development. I also plan to repeat the design sequence and ADDIE process on future projects in order to enhance my work and to further understand practices for designing computer-based instructional materials.

In addition to this primary conclusion that experience is essential for understanding the sequence and process, there are several other important conclusions which may be drawn from this experience and used to help instructors mentor students through the design and creation of computer-based instructional materials. First, guidance during the early stages of selecting and narrowing a project is essential. Without this help, projects are likely to be too broad and will be difficult or impossible to accomplish in a timely manner consistent and will not be suited to the purpose of learning and practicing the ADDIE process. Second, students benefit when given flexibility to proceed with designing technology based instructional media for a familiar content area and setting. Such a situated project allows the student to focus on the design sequence. Third, the guidance and oversight are necessary in the design step to help ensure that all aspects have been addressed. I would have benefited from more directed guidance at this point for incorporating assessment, and peers expressed in discussions throughout the course various design steps items they had forgotten or neglected as well [9]. Finally, I felt I benefitted greatly from seeing the work of others in the class and from the feedback colleagues provide; this should be facilitated and encouraged at multiple stages. Each of these will help students to negotiate the ADDIE process and have a successful and educational initial experience with technologically based instructional design.

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