Frameworks for Facilitating Research Thinking:
Redesigning a Residential Course for Online Use in Higher Education

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Abstract

The purpose of this study was to document the redesign of an existing doctoral reading course for online environment. This design process includes contributions from van Merriënboer's 4C/ID model and Frick's Totally Integrated Education (TIE) theory, and the redevelopment of course objectives to meet strategic goals within the doctoral program.

Design Context

The Instructional Systems Technology (IST) department at Indiana University (IU) had requested (and received) approval for a new online doctor of education (Ed.D.) degree program, and there was a defined need for existing classroom courses to be converted to an online format. The researchers identified a number of existing residential courses that would require conversion, and selected a doctoral reading course, with a second choice of an introductory course in research methods in IST. The researchers began the conversion of the referenced reading course, R711, in Fall 2010. The anticipated start date for the online course is Fall 2012. This design case documents our design process in converting the residential course to an online format, including rethinking of core course objectives, and methods to effectively meet course objectives in an online setting.

The existing residential course intends to familiarize IST doctoral students with seminal and current readings, and to help students construct frameworks for their continuing development as scholars in the field. Students enrolled in this course have either a Master's degree in instructional technology or have previously taken core courses in IST. This reading course covers a variety of topics in the IST field, including instruction and learning, design and development theory, systems, evaluation, and human performance technology. The residential section of this course has historically been offered in the fall semester, with 10 to 20 students enrolled, including both IST doctoral students and other students minoring in IST.

In the residential R711 course, students meet once a week to discuss various seminal topics in IST with readings selected by the instructor and the department. Additional course tasks include the critique of selected readings and the completion of a literature review on a topic within the field. The existing course included an established syllabus, set of course goals, and associated list of required readings. The goals of the course included: 1) develop an understanding of key issues and concepts within IST; 2) develop the ability to critically analyze and synthesize IST-related publications from a variety of perspectives; and, 3) develop a literature review for a topic of interest within IST. Due to the unique role of a reading course in establishing an overview of an entire field, a variety of readings, drawing from handbooks, seminal books, and journal articles were included in the list. Also, due to the rapid progression of the literature, the reading list had been modified multiple times in the past five to ten years to add more recent readings or reflect new trends in the field.

The design team for this project included four first-year IST doctoral students (as of Fall 2010), one IST post-doctoral student, and the chair of the IST department, who served as the key stakeholder for the project. Three members of the design team had significant previous experience in instructional design settings, and the majority of members also had teaching experience. Three members were in the process of taking the residential course when the redevelopment work began, and the remaining doctoral student took the course during the second year of the course redesign effort.

The primary setting of the design process was a weekly group meeting, where progress was discussed and tasks were assigned. During each of these meetings, starting in November 2010, detailed notes were taken in a Google Docs document, allowing a primary note taker to capture the contents of the meeting and any applicable design decisions, while other group members could log into the same document to add comments or additional notes. This capability allowed for ongoing triangulation of data captured from the primary work sessions on this project. The project goals for this research were originally directed towards formative research (Reigeluth& Frick, 1999), but team members ensured that the documentation of the project was flexible enough to allow for a variety of methodological discussions. In conjunction with the goals of formative research, a design method was identified to structure the design process. The method selected was based on the book *Ten Steps to Complex Learning* (van Merriënboer&Kirschner, 2007), and the associated Four-Component Instructional Design model (4C/ID) (first introduced as a model in van Merriënboer, 1997).

Designing the Course

The general timeline of our design process spanned from Fall 2010 to Fall 2011, moving from initial concept and data gathering to identifying authentic tasks to rapid prototyping of potential structures to finalization of the core concepts and course structure. Each stage of the design process will be explained further in the following sections.

Initial Concept and Data Gathering

Due to the departmental need for an online version of the existing doctoral reading course, our end goal was defined early in the process. The doctoral reading course was selected among other potential courses due to its

placement early in the doctoral program, and because the department chair leading the design process was not involved in the everyday teaching of this course.

The project began as an evaluative process, including the administration of a custom course evaluation instrument (Frick, Chadha, Watson, &Zlatkovska, 2010) to the Fall 2010 residential course. This evaluation was administered in December 2010, and individuals from the residential course were asked to participate in a short interview to provide information about their experiences in the course. Nine students were interviewed about their experiences in the course, including questions about potential improvements, the effectiveness of teaching strategies, and the role of the course in helping them solve real-world problems. In addition, two former instructors, each with at least three years of experience teaching the course, were interviewed in our group meeting. The faculty answered a set of questions similar to those posed to the students, with additional followup questions about the planning of the course and what teaching strategies had worked most effectively in the past.

Ten Steps

After solidifying the concept of an online doctoral course and parallel to collecting data about the current iteration of the residential course, formal development of the new course structure began. Early in the Fall 2010 semester, the design team had decided to use *Ten Steps to Complex Learning* (van Merriënboer&Kirschner, 2007) to structure the design of the course. This decision was made due to several factors, including interest by several team members in applying this newer design methodology to a real-world problem, lack of case studies exploring the real world use of this model, and the presence of complex learning elements in the course that the group chose to redesign.

The first step of the model, designing the learning tasks, was the most daunting. These tasks, based on the 4C/ID model, were intended to be authentic whole tasks. In other words, the tasks should be ones that professionals would execute in the real world (authentic) and indicate a set of actions that would be representative of a complete task (whole) performed in the real world, not an isolated set of procedures. The group struggled to find a single authentic, whole task that met these criteria. The first approach was group brainstorming, with an output of recommended whole tasks that could be used in the final course. Several group members presented their concepts, many of which were based on goals for the course referenced in the interviews by previous faculty. Some of these concepts included the importance of academic reading skills (using the seminal book by Adler & van Doren, *How to Read a Book*), how to talk as an academician, and the sequence of reading research with understanding, critiquing the reading, then presenting the findings to others.

In the design discussion, the team agreed that the student executing the real world task in the course was a researcher or researcher-practitioner applying their knowledge of the field to new problems or literature. This profile represented our target audience for this design, and is consistent with the goals of the doctoral program in which this course is placed. With this conclusion regarding the target audience, the design team then turned to the competencies of a researcher to understand and synthesize research literature, including the primacy of understanding the knowledge claim. While consistent structures exist in the text of most research literature—literature reviews, methods, data collection, and analysis—the core of each article includes knowledge claims the author was making, either based on previous research or their own research. The design team progressed in thinking about how to know whether the claims an individual author is making should be believed, and on what basis they should be believed.

During this process to find the one whole task that would inform the course design, several weeks were spent discussing theories of knowing, including the theory of Totally Integrated Education (TIE, see Frick, 2011) and its basis in the work of Peirce (1932), Short (2007), Maccia (1987; 1988), and Steiner (1988). Although these materials were beneficial, the design team felt a conflict between TIE and our design process to that point, but a hybrid of the two approaches was attempted. In retrospect, this investigative look into theories of knowing was helpful, but drew the team away from the core goals of the course, and caused the team to lose context with the larger deliverables in the course. In particular, this focus indicated a shift toward the more cognitive aspect of the course, meanwhile neglecting the holistic vantage point we had begun exploring early in the design process (especially in initial brainstorming). In further exploration of the theories of knowing, the research team developed a flowchart of questions that would need to be asked regarding an individual knowledge claim in order to know whether that knowledge claim is justified. Also included in this inspection of a knowledge claim is the role of personal experience in validating or invalidating the claim. This flowchart explains the process a student might go through for each identified knowledge claim (Figure 1). During the Spring 2011 semester, the work-in-progress for this course redesign was presented at the IU IST Conference roundtable, and additional feedback was solicited from the attendees. Their feedback included discussion of what whole tasks might be appropriate, and the necessity of

understanding which articles were appropriate or not for beginning researchers (and what basis on which something should be judged as appropriate).
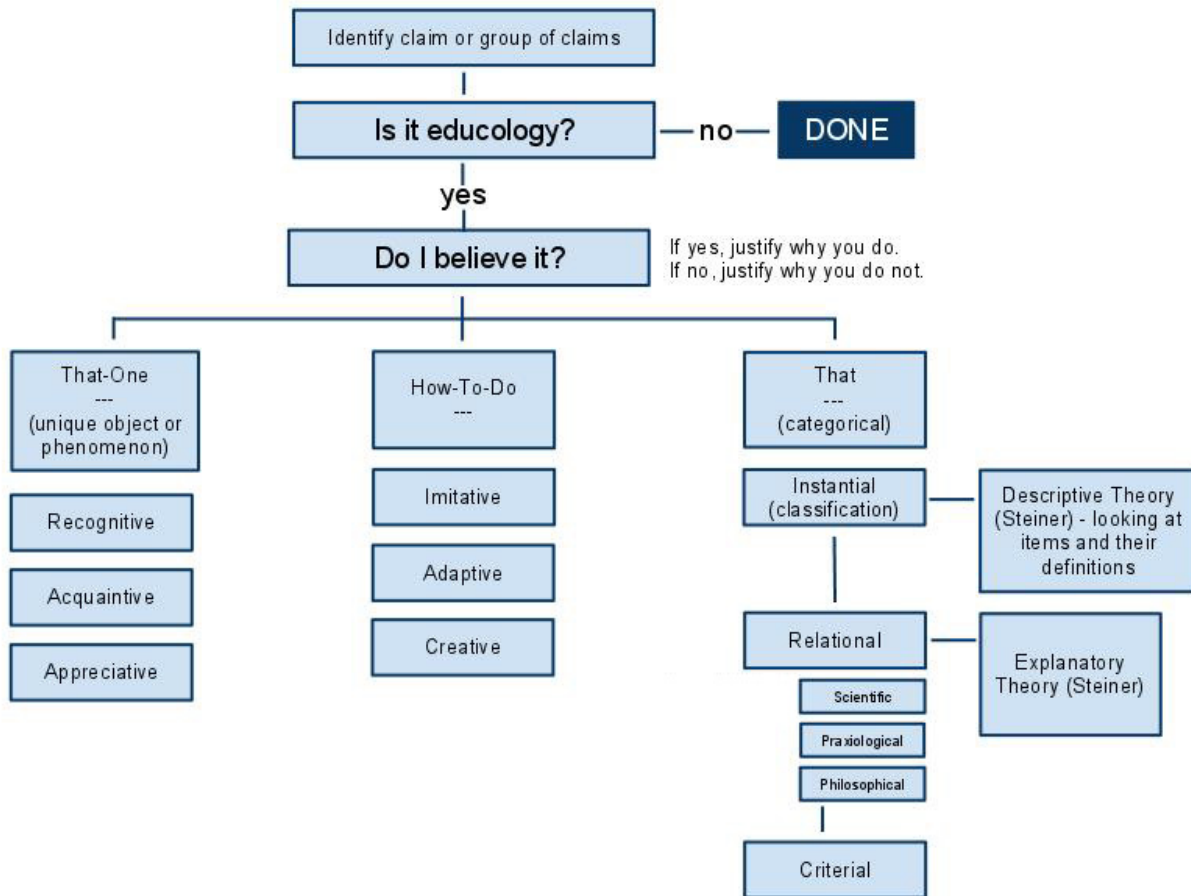

Figure 1. Flowchart of analyzing a knowledge claim.

Pilot Testing

Once the flowchart was in draft form, the design team conducted a pilot test using a controversial article from the doctoral reading course syllabus. Each team member read the article individually, highlighting each knowledge claim they could find. In the next team meeting, the team members formed a consensus about which knowledge claims were foregrounded, and came to the conclusion that there were one or two primary claims in most articles, and then a large number of secondary claims that supported the primary claims. The design team then progressed through the flowchart using the identified primary claims, discussing the levels of application to educology (having to do with education), personal belief, and category of the knowledge claim.

After this pilot testing, the team began to consider the second step in the 4C/ID model: sequence task classes. In the 4C/ID model, a task class is created for each real world task (or subsidiary whole task) and individual iterations of that whole task are sequenced from easy to hard. The team first separated the flowchart model into four task classes: identifying the knowledge claim, belief of the claim, category of knowledge claim, and type of knowledge claim (within the category). At this juncture in the design process, the semester was drawing to a close, and although we had identified a tenable whole task and related task classes, we had really just worked through the first or second defined step of the 4C/ID process we originally intended to follow. Although the focus was on the whole task and task class concepts, inevitably, discussion included other elements of the design process not explicitly referenced in the early stages of the defined design process. These included practical scheduling

considerations within the planned semester of coursework, the role of task classes that interacted with each other (or were sequenced against each other), and potential delivery methods for the final instruction.

Organization and Prototyping

The summer work session for this project included the chair of the department, still serving as a key stakeholder, and two members of the design team. Each of these members had taken the residential course in Fall 2010 and had previous instructional design experience. The first two weeks of the summer served as a planning period, including the creation of goals, a project timeline, and initial work towards the organization of materials within task classes. Similar to the design group meetings during the semester, notes of what tasks were accomplished were taken in Google Docs to establish progress and accountability throughout the summer. Early in the design process, the team became acquainted with a text often used in social science research by Booth, Colomb, & Williams (1995) entitled *The Craft of Research*. This text generated additional discussion between the summer design team regarding reading research literature, and in particular, clarifying the role of knowledge claims independently from the team's experience with TIE theory. This text was used as a reference for the remainder of the summer, and was included as a recommended reading in the overall course structure.

The initial summer timeline included design and development work on the site, with completion of the main design tasks by early July 2011 (Figure 2). In conjunction with this timeline, a plan for creating task classes, supportive materials, and just-in-time (JIT) materials was detailed. In addition, a course site housing this information was planned, to allow for quick adoption of the course and related materials once the course was offered in the online format.
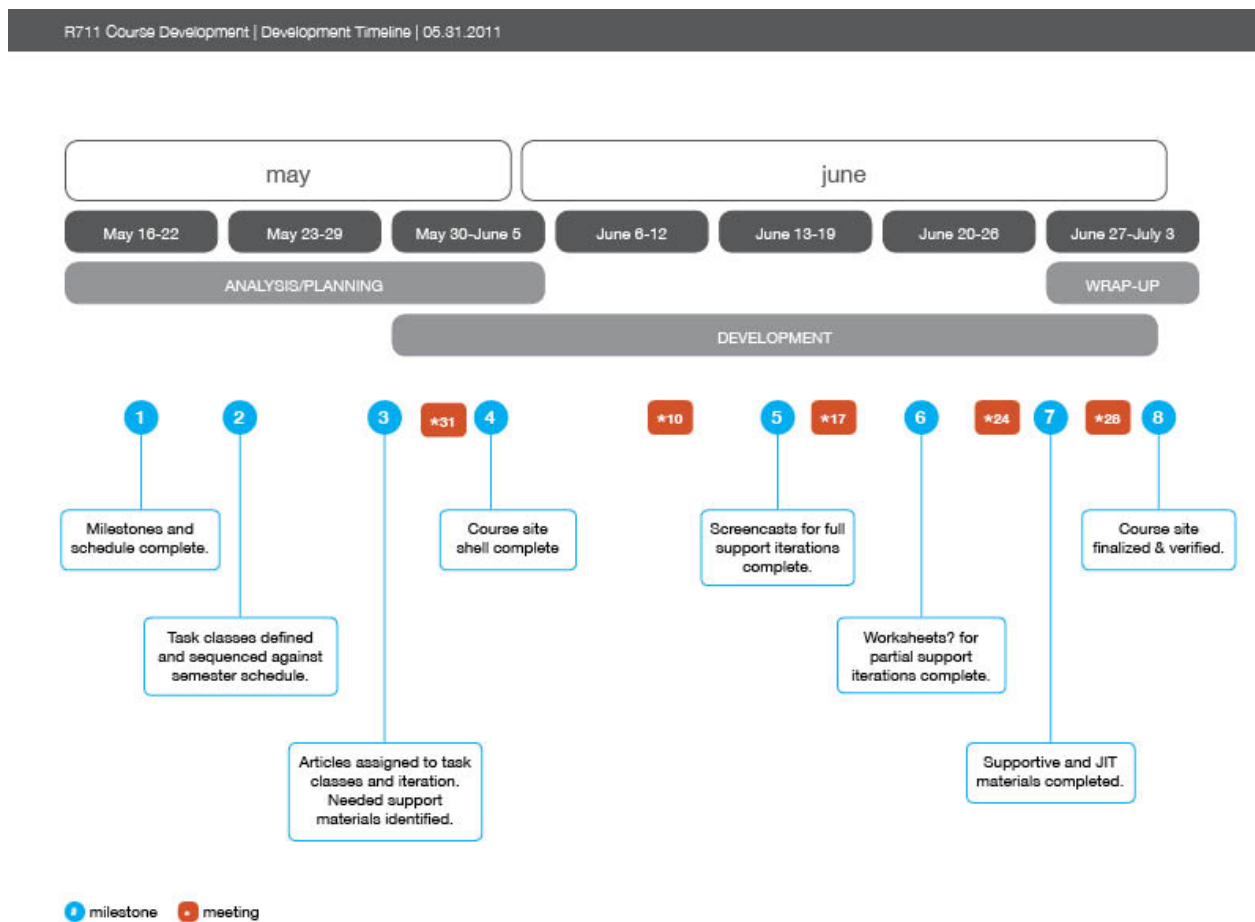

Figure 2. Development Timeline for Summer Work

In parallel with the development of the project timeline, existing reading materials for the course were quickly evaluated and mapped against the task classes the group had defined during the spring semester. Several major design decisions were made during this brief period of rapid prototyping, including: merging related reading themes from the residential course into single blocks of content (Design and Development, Learning and Instruction, etc.) and adopting the theme structure as an organizing concept. The second decision, utilizing themes as an organizing structure in the course, was made in order to present some continuity of thought throughout the course. A "spiral" structure was discussed, including reading an article from the majority of themes each week, but the lack of congruity between readings, along with minimal opportunities to critique opposing viewpoints offered by reading multiple perspectives within a single theme, outweighed the potential for cross-theme evaluation and exploration.

The organization of the articles and themes against the task class structure took place over a two-week period at the beginning of the summer, following a rapid prototyping method. This method emphasizes quick exploration of multiple "what if" scenarios and allows for user feedback without the need for full development, allowing a wide range of design possibilities to be explored without an overwhelming time commitment. Rationale for sorting the themes included potentially applicable content to focus on the unique goals of each task class. Since the explication of "how to" claims (located in the final task class, categorization of knowledge claims) was only present in a direct sense in the design and development literature, those themes were moved toward the last task class, with easier readings or readings with more direct knowledge claims placed closer to the first task class. In association with the reorganizing of the materials against task classes, readings were identified as being directly associated with the task class (following the strategy flowchart of knowledge claims, belief, and categorization) or as supportive or just-in-time information, based on the content of each reading (see Figure 3 for a sample task class). Some readings were recommended for removal due to age or the emergence of newer trends in the field that were important to explore, or lack of application of the reading to the strengths of the task class structure. Similarly, some readings had been revised in newer editions, and these more recent versions of the content may offer additional currency to the course.
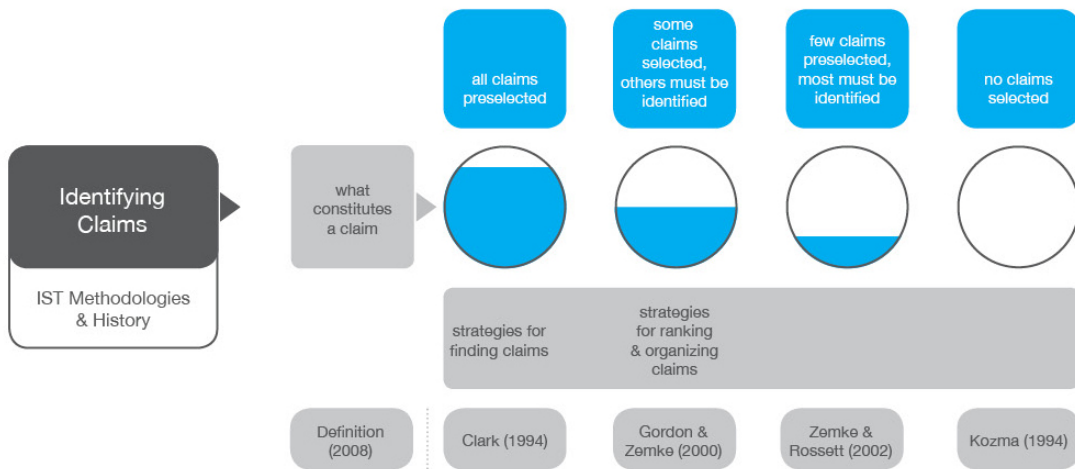

Figure 3. The first task class, representing one theme of readings.

After several iterations between the two primary designers, a proposed set of task classes was presented to the stakeholder, and was provisionally approved. Several features existed in the provisional task classes, including the presence of new content to more directly align with the needs of the task class, updated editions of content where available, and the categorization of some readings as optional or supportive information rather than as required reading that contributed directly to the faded task class. The supportive information was seen as a flexible concept, since students in the course come from a variety of educational backgrounds, and may have a wide range of previous

knowledge in various fields discussed in this course. Therefore, while some students may need more foundational readings on basic concepts, other students may already have a firm grasp of these concepts and may find some supportive readings less helpful.

In addition to the design timeline and task classes, a proposed semester schedule for the class was also created, attempting to map each theme and its underlying task class onto a specific week (Figure 4). Major milestones for critique submissions or literature reviews were also defined, as well as special topic discussions at the beginning of the semester and student presentations of their literature review findings at the end of the semester.
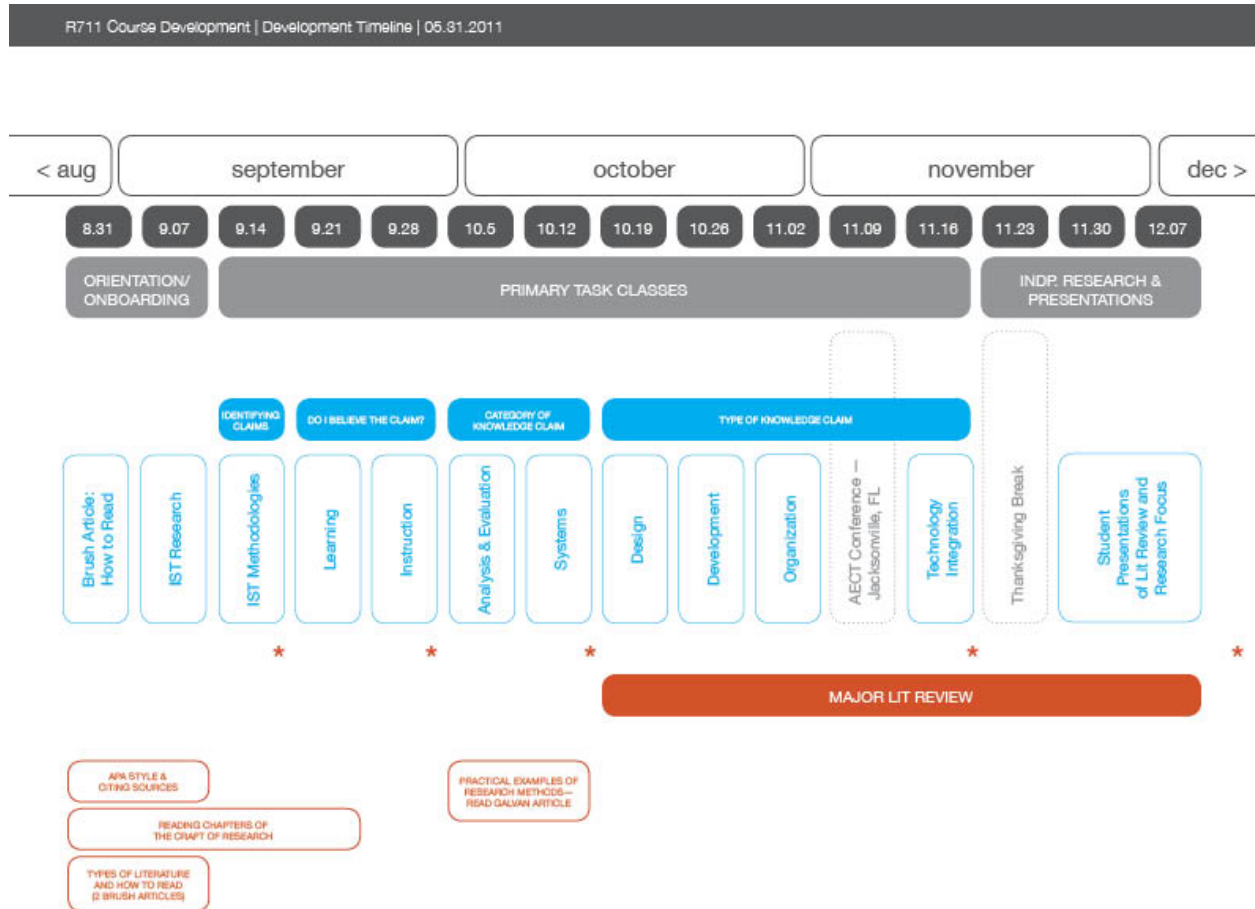

Figure 4. Provisional semester course schedule.

After identifying a structure for the contents of the course against the predefined task classes, additional investigation into the types of supportive and JIT information was needed. While this represented a natural next step according to the 4C/ID model, it also represented a practical step toward completing a section of the course in order to conduct a more thorough evaluation. One of the first design decisions within this task goal was to provide student and professor support by identifying knowledge claims in all articles used or referenced in the course. Practically, supportive materials could be built on top of knowledge claims throughout the course, since the first task class began with the goal of identifying knowledge claims, and all subsidiary task classes relied on a knowledge claim to begin the analysis process. The stakeholder decided that identifying these baseline knowledge claims was critical to understanding what type of supportive information (or sequence of fading supportive information) would be most helpful. The two designers split the readings based on their respective research interests and areas of expertise, with one designer addressing Learning and Instruction, Technology Integration, Systems, and Analysis & Evaluation. The other designer addressed the Design & Development, IST Methodologies, and Organization themes. Each designer worked on the project materials using a shared Dropbox folder, allowing constant communication as to

which articles had been completed and to provide version history of the documentation effort. Each article was annotated using Adobe Acrobat, with a combination of highlighting and comments to identify knowledge claims. During this identification of claims, it became clear that triangulation for this process was needed, as each designer tended to identify claims that were most interesting to them personally, or the claims that were most articulated by the article (as opposed to claims from cited materials). To address this issue, the stakeholder agreed that the designers should review each other's claims after each reading was complete.

Roadblock

During the identification of claims process, in the first few weeks of the summer, one of the primary designers was diagnosed with mononucleosis, and was now unavailable for the remainder of the summer. Since the triangulation process had just begun, and issues were yet unresolved as to whether all identified claims should be highlighted or just the primary or dominant claims in the article, the project reached an impasse. After this roadblock, the process moved more slowly, and the design process increasingly revolved around the identification of claims, ignoring the larger context of the supportive materials these claims were intended to inform. In addition, the loss of design knowledge from the absent designer complicated the process, and resulted in a change of strategy to make the best of use time available.

The "Box"

Close to the middle of the summer, an incoming doctoral student with little background knowledge of IST was identified. This student volunteered to review the articles and related annotations and complete part of the flowchart with each article as a point of triangulation. After one of the designers became ill, the emphasis on a digital workflow (with planned efficiencies in creating final supportive materials) was reduced, primarily due to lack of communication by that designer with the rest of the group in relation to these goals. Eye fatigue and lack of readability of some of the materials on a digital screen took their toll, and the decision was made to transition to paper copies of each article to complete the annotation process. A cardboard box was obtained to house these articles (39 readings in all), using tabs to represent each theme or task and a hanging folder to represent each reading within the task (Figure 5). This box was organized by the remaining designer, and then passed off to the student volunteer for review. Although the paper articles were found to be helpful in reducing eye strain, the remaining researchers also found the box a helpful physical gauge of what articles had been completed, and what articles still remained to be annotated.

The student volunteer read each article, agreeing or disagreeing with the annotated knowledge claims, then proceeding to the next step in the knowledge claim flowchart, stating their belief in the claim (or lack of belief) and offering supportive evidence in the form of vicarious or lived experience. After conferring with this student at the beginning of the Fall 2011 semester, it became clear that this process was difficult in many cases, especially when attempting to respond to each subsidiary knowledge claim identified in the article. The student used a strategy similar to that identified by the designers early in the Spring semester, clustering sub-claims under one or more main claims. The volunteer found it much easier to work through the materials, identifying this "main claim" from a cluster of supporting sub-claims, then analyzing that main claim through the lens of belief.

Near the end of the summer, two faculty members met with the key stakeholder to discuss the progress of the course redesign. The initial concern preceding the meeting was the delay in discussing the progress of the redesign efforts. This delay was due to scheduling conflicts and the slower pace of the design team after the exit of an ill team member. The stakeholder presented the task classes as a the core of the new course, but the new structure of the course was not readily apparent—it was too complex to be easily understood, especially the design team's path to identifying the "whole task." In addition to this complexity, it was unclear from the design process what the instructor's role would be in the online or residential setting based on the new structure. In other words, how would the instructor teach the class, and how would it parallel or deviate from the existing course structure? This served as a design failure, in that the team did not solicit and receive feedback from former and new professors teaching the course early enough in the design process once the structural elements of the course were identified. In addition, the results of the meeting, in addition to later conversations discussed in the next section, revealed the narrow focus of the redesign efforts at this stage, especially in regard to implementation in the classroom and online environment.

New Semester, New Instructor

The Fall 2011 semester began with a new urgency for the completion of this course redesign for the online setting. In August 2011, the department received final approval for the online Ed.D. program, and applications began to be received for the Fall 2012 semester. This new course was slated to be offered during the first semester to new students as a foundational doctoral course. Changes within the residential course were also in progress, with a new professor teaching the course during the Fall 2011 semester. This new professor was experienced, and had taught a wide range of courses in the past, but had not taught this course previously. She had been part of the meetings with the key stakeholder during the summer design process, and sought out one of the design team members from the research group when planning the course syllabus in late August 2011.

The residential course requirements were set to remain largely the same, with similar deliverables and readings as in previous semesters. However, careful attention was given to the outcomes of the design process thus far, particularly in the importance of recognizing knowledge claims to complete a critique of an article. The conversation about the course transitioned into a design discussion, establishing which findings from the design process thus far would be most beneficial in a residential setting, and would prove most effective with that particular professor. The main focus of discussion was the readings, and how to most effectively cover the materials during the face-to-face class. The second focus was the deliverables of the course, a topic that had been pushed aside early in the design process, but was quite important to address in the residential context through the lens of our design process to that point.

Figure 5. The box used to contain readings with annotations and student review comments.

Figure 6. A proposed layout for the article critique and the final article critique template.

A number of readings had been targeted over the summer, both in terms of locating primary claims, and in identifying newer or more appropriate articles for the goals of the course. During the design discussion with the new residential professor, the standard reading list (as used in previous versions of the course) was adopted, with any changes to be addressed on a week-by-week basis. Although some of the updated readings may have been helpful from the perspective of recency, it was decided to stabilize the course along this dimension and focus more actively on the application of these readings within the context of the in-class critique and discussion. One of the most important indicators that a student had actively read the articles in previous versions of the course was the completion of a required article critique on one article each week. While this critique was helpful, a more targeted critique requiring the student to interact with individual knowledge claims was found to be more helpful. Therefore, a new article critique template was developed (see Figure 6), requiring the student to identify a primary claim from one article each week, then support that claim using a source from the article's references, and a source that the

student has identified independently. In addition to this critique document, each student was required to present an assigned article (using their critique as a basis of discussion) once during the semester. The concept of fading and task classes as identified in our summer design process was largely discarded, with the repetition of tasks seen as too cumbersome and time consuming. In addition, the ability to focus on single articles for a student critique allowed time resources to be spent in a more targeted way.

While fading, as a concept for sequencing the readings, was discarded as planned in the design process, it was used in a more powerful way in sequencing the deliverables for the course. The previous residential course required weekly critiques, a minor literature review (approximately 5 pages) at the midpoint of the semester, and a major literature review (approximately 15 pages) at the end of the course. These deliverables had been disconnected in the past, and required independent research to complete each task. In this planning session for the Fall 2011 semester, however, these deliverables were rethought and linked together to establish one chain of tasks with decreasing support and increasing complexity. The critique has already been discussed, with the goal of identifying and supporting knowledge claims both through existing article references and the location of an independent source. This idea was expanded for the minor literature review, replacing a formal literature review with an annotated bibliography. Each entry in the annotated bibliography could pull information directly from a critique, similar to what was being completed each week, with each critique introducing a new source to be analyzed. The topic for the major literature review would be decided by the student and professor earlier in the semester, so that the annotated bibliography could serve as a planning mechanism for the major literature review due at the end of the semester. This sequence of tasks allowed an integration of classroom critique and primary deliverables in a new way, based on the concept of knowledge claims.

Once this structure had been planned, the semester began. One of the design team members observed the new residential course to see how the feedback from the design team was implemented in a face-to-face context. In addition, that same design team member was taking a reading course in another department that served similar goals as the IST doctoral reading course, which provided additional perspective on the standard areas of focus for this genre of course. The observation of the IST course brought out some primary pathways of working through the knowledge claim and support process, including the following strategy: find a claim, locate support (either internal to the text or through an article reference), and judge the claim based on the support provided. This pattern of finding knowledge claims and supporting them (with the required support needed seen as a function of the believability of that claim) was seen as the primary critique activity carried out in the classroom environment, and as a primary generator for in-class discussion. This same pattern was also emphasized in the individual critique documents, which also served as a generator for class discussion.

The external readings course was also seen as a source of inspiration, in that it focused on the importance of knowledge claims and the related epistemology and ontology that the claims spring from. In this way, this course mirrored many of the goals identified in our design process, albeit in different terms, and served as a validation that our design process was directionally appropriate.

Prepping for Online

Early on in the design process, during the Fall 2010 semester, the design team discussed aspects of online education that could work in supporting the course under consideration. The discussion included common course elements such as discussion forums, chat, and wikis, as well as more collaborative tools like Google Docs, screencasts, and computer-adaptive supportive materials.

One of the most important activities identified by the design team as vital for inclusion in the online course was the process of critique. While the face-to-face version of critique is easily accomplished, establishing online dialogue in this sense, particularly when students cross multiple time zones with a variety of technology capabilities, can be quite difficult. For this foundational concept of critique, various methods have been discussed, which include a fading of support and increasing difficulty. One possibility might include a webcast/screencast by a professor that includes a demonstration of the critique process using an article the student has been required to read. Then, the students might work in small groups or individually to write a critique then present it using a YouTube or Adobe Connect video presentation, mirroring the presentation component of the residential course. This demonstration component not only strengthens the critique competencies of the individual presenter, but also reinforces good critique behavior for the rest of the students in the course. In addition, tools such as YouTube annotations could be used to allow students in the course to interact with the video presentation in an asynchronous way, asking questions or locating issues that could be further discussed in a Google Doc or forum thread.

The additional deliverables for the course, including the weekly critiques, annotated bibliography, and major literature review, could be easily accomplished in the online setting, using support for individual article

critiques (as discussed above) to inform these larger deliverables. Establishing lines of communication with residential students in the online setting (assuming online and residential courses were offered in the same semester) could also create a larger student community for sharing of knowledge claims and article annotations, as well as additional opportunities for discussion and support.

Final Design

While the final design of the course is not yet complete, this design case represents the process of developing the course structure over the period of approximately one year (through October 1, 2011). There are a number of specific design decisions that will still need to be made, including how students and faculty will interact in an online setting, what materials and methods will be used to facilitate this interaction, and how the final interaction experience might mirror or diverge from the defined residential course experience.

This design process has served to finalize a course framework, not only identifying which authentic tasks are most important to meet specified course objectives, but also creating activities and environments to support these tasks in both residential and online contexts. While this design process took much longer than we originally anticipated, one of the biggest challenges was to identify and sequence whole tasks for this particular R711 readings course. This process should go more smoothly for courses already organized around tasks, such as the R690 class (Application of Research Methods to IST Issues). Nonetheless, the process of shifting from a topic-centered course organization to a task-centered organization may be one of the biggest challenges in attempting to use the 4C/ID model to guide the design process.

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