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Task Analysis Portfolio

George Bradford, Taryn Hess, Damon Regan

Advanced Instructional Design

February 10, 2008

Introduction

This analysis portfolio demonstrates our ability to analyze learning tasks using a variety of methods described by Jonassen, Tessmer, and Hannum (1999). This portfolio describes our application of three specific analysis methods after reviewing our approach to method selection and knowledge elicitation. It provides insights into our thinking as it changed throughout the process of developing this portfolio. We conclude with our reflections of the entire process.

Task Analysis Method Selection

We initially selected three task analysis methods based on two assumptions: different task analysis methods have different purposes and our focus was on content. The former assumption was based on Table 3.2 of Unit 3 Supplemental Material and reviewing the assumptions of each analysis method covered by Jonassen, Tessmer, and Hannum (1999). The latter assumption was based on our view that we were developing content for a unit in a course.

This initial focus on content analysis was also based on our perceived relationship to an expert in formative or developmental research. In sections II and III of the Jonassen, Tessmer, and Hannum (1999) book, these parts were described as watching an expert perform sequential steps. The methods in section IV seemed to assume that you could ask the expert what he or she was thinking as the task was being performed. Part V depicted an expert working in the natural environment where the designer could observe as each task was completed. Then in Part VI the methods were portrayed as an expert providing documented content which would later be analyzed. Not being able to observe an expert complete the learning task, we assumed we were limited to a relationship with the expert that depended on the content they created.

Knowledge Elicitation

We decided to conduct a documentation analysis in an attempt to elicit expert knowledge and orient ourselves to the language and content culture of formative and design and development research (Jonassen, Tessmer, & Hannum, 1999, p. 237). As we carried out our documentation analysis and identified relationships between concepts and procedures, we mindfully reviewed the assignment description which required that the three analysis methods be derived from separate categories as defined by Jonassen et al. With this greater understanding of the topic and the requirement, we arrived at our final selection of analysis methods: Conceptual Graph Analysis, Hierarchical Analysis, and Case-Based Reasoning.

Based on our document analysis findings, we collaboratively decided on a goal, terminal objective and outlined content for our project. These were used to guide our three task analysis techniques in order to ensure our methods would produce reliable and valid outcomes. The goal statement was: students will distinguish and explain formative and design and development research methodologies. Our terminal objective was: students will distinguish between formative research and design and development research and explain the general methodologies, applications, and methodological issues associated with this research. The scope of this terminal objective is intended to include the following concepts and principles: (a) formative research, (b) design and development research, (c) the principle of knowing the difference between each, (d) general methodologies, (e) research applications, (f) methodological issues, (g) evaluation criteria, and (h) the relationship to formative evaluation.

Conceptual Graph Analysis

The conceptual graph analysis method was used to represent the structure of a formative and design & development research expert's knowledge. This classification of use represented a

combination of interests in capturing concepts, procedures, taxonomic hierarchies, etc. (Jonassen, Tessmer, & Hannum, 1999). We then constructed a rough graph as we analyzed the Reigeluth and Frick (1999) chapter on formative research and the Richey and Klein (2007) book on design and development research. This was facilitated by considering question probes (e.g., what is __?, what are types of __?, what are the parts of __?) recommended by Jonassen et al. during our document analysis. We then made several iterations of the graph to consolidate common concepts to the extent possible.

The specific steps for CGA outlined by Jonassen, Tessmer & Hannum (1999):

1. Clarify the use for the graph information
2. Choose a set of situations for the expert to analyze
3. Construct a rough graph
4. Prepare a list of follow-up questions
5. Expand the graph
6. Review the graph (Refer to Appendix 1)

Reflection

This method enabled us to represent concept relationships as well as procedural knowledge. This enabled a greater degree of freedom in analyzing the task than allowed by the goal analysis method recommended by Dick, Carey, and Carey (2005) or the information processing analysis method recommended by Smith and Ragan (2005). On the one hand, this enhanced freedom supported the document analysis task of learning the language and content of the two fields of research (formative and design & development). On the other hand, this freedom prevented us from clarifying our goal as we analyzed it, which the procedural goal analysis methods recommended by Dick et al. (2005) and Smith & Ragan (2005) provide.

Jonassen, Tessmer, and Hannum (1999) come to a similar conclusion: “to elicit procedural knowledge, it may be best to use techniques such as Procedural Analysis or Information Processing Analysis to replace or complement [Conceptual Graph Analysis]” (p. 206).

Hierarchical Analysis

Much like subordinate skills analysis, hierarchy analysis seeks to identify prerequisites skills the learner will need prior to engagement. Jonassen, Tessmer & Hannum (1999) state that this analysis technique can be used when the “learner will use a concept, apply a rule or solve a problem” (p. 77). This method provides a hierarchy of skills and knowledge needed to achieve the end goal. The analysis assumes that the learning objective is situated in the intellectual skills domain and the order of prerequisite skills needed is listed from simple to complex.

The procedural steps for this analysis technique are listed by Jonassen et al. (1999) as the following:

1. Familiarize yourself with the topic using a knowledge elicitation technique.
2. State the final learning outcome
3. Identify the entering capabilities the learners have in regard to the final learning outcomes.
4. Identify first-level prerequisites
5. Identify second-level prerequisites
6. Identify third- and subsequent level prerequisites
7. Determine how far to go in breaking down the prerequisites
8. Construct the learning hierarchy (Refer to Appendix 2)
9. Verify the learning hierarchy

Reflection

Initially, a documentation analysis was used to elicit subject-matter content. It was a valuable step since it guided the tiered prerequisite levels. If one were to ignore this technique, significant sequencing of content could be lost and therefore decreasing the overall validity and reliability of the analysis findings. In general, this task-analysis could be useful to clarify necessary steps and/or skills needed for a learner to meet an objective. In agreement with Jonassen et al. (2004), this technique does not allow for the use of other learning taxonomies. A designer should be able to have the opportunity to use this technique regardless of the taxonomy.

The decision to use this technique was based on the team's goal and terminal objective statement as well as prior experience using a similar technique (i.e., subordinate skills analysis). Although the techniques are similar in function, focusing on deriving prerequisite skills/entry behaviors, the hierarchy analysis was more challenging to implement. Developing the specific learning outcome was relatively unproblematic however identifying the prerequisite skills (rule, defined concept and verbal information) took a large amount of time and effort. As stated previously, the document analysis proved to be an important first step. Without having this completed, recognizing the hierarchical skills would have been nearly impossible. These documents were referenced multiple times to ensure skills were appropriately derived. In conclusion, the technique was a good learning experience however was not the most valuable task-analysis method for our project. Even though insightful information was gained (prerequisite skills for a specific learning objective), the multiple learning outcomes desired by the project (some of which are not based in the intellectual skills domain) can not be covered due to this techniques inherent lack of flexibility and breadth of coverage.

Case-Based Reasoning Analysis

Jonassen, Tessmer, and Hannum (1999) identify case-based reasoning as an analysis approach within the category *Cognitive Task Analysis Methods*. When attempting to elicit knowledge from experts, the results are often recounted as stories. While stories can be powerful instructional tools, they can be equally difficult to extract in such a way as to prepare them for storage and ready access by information seekers. Stories are "…the stuff that builds connections between people as well as between layers of content" (Ganske, 2007, p. 337). Case-based reasoning offers an approach to capture information stored as stories, and it would appear to offer a means by which to conduct analysis on the same stories.

Jonassen et al. explain that the "...major reasons for recalling stories and reasoning using cases is to help us solve problems, design things, plan for activities or events, diagnose situations, explain phenomena, justify beliefs or argue for or against ideas, classify and interpret new phenomena, or predict effects (Kolodner, 1992)" (Jonassen et al., 1999, p. 147). Case-based reasoning can be used in two ways: problem solving and interpretation, where problem solving is the most common application. We diagnose problems, hypothesize solutions, and design applications using case-based reasoning (CBR). If new problems are found to be similar to old, we use what we know about the old to expedite solving the new. If old cases do not fit or are not applicable to new problems, CBR practitioners adapt the old solution to meet the needs of the new. "CBR is an effective way to learn or improve upon any skill. CBR is, generally, how people become experts and how experts often reason about problems in their domains of expertise" (Schank, Berman, and Macpherson, 1999, p. 167).

Experts need to be able to organize their experiences that they will be able to make use of the information when the need arises. This organization is called *indexing* (Jonassen et al., 1999;

Schank et al., 1999). A form for collecting information that supports indexing was created for this assignment and can be viewed at the following URL: http://heybradfords.com/moonlight/node/add/eduresearch-isd. The information fields within this form are designed to provide a structured organization of the collected case information with specialized fields to promote indexing. This structured format is presented in nearly identical form as that presented by Jonassen et al. on page 150, except for the final two fields, the first of which is designed to permit unstructured indexing by permitting free-form tagging (i.e., indexing): users are encouraged to use a tagging system, such as del.icio.us, and then to provide some means by which those tags might be incorporated within the CBR tool by providing a link to those custom tags in the final Feedback field. This author intends that this can be useful as an exploratory tool to analyze complex information domains, which, potentially, can be later used to expedite similar problem solving, or new problem / content / situation / instructional analyses.

Jonassen et al. instruct the user of CBR to first identify instructive cases. Kolodner (1993) indicates that such cases might be identified as having the following characteristics:

- "Represent specific knowledge tied to a context
- May cover small or large chunks of time
- Records experiences that are different from what was expected
- Possesses useful lessons that helped the problem solver achieve some goal or that warn of potential failure" (Jonassen et al., 1999, p. 150).

This sets the stage for developing a knowledge base of cases that might be collected and indexed. The importance of indexing cannot be understated. According to Schank (in Jonassen et al., 1999), intelligence can be argued as being nothing more than a "massive indexing and retrieval scheme." This makes intuitive sense: if you cannot access information, the information

has little to no value; if a person has ready access to any needed information, this person can appear to be *intelligent*. The format as identified for capturing stories using case-based reasoning includes multiple content areas to promote broad indexing. This strategy was enhanced in the present model to include a link to permit cross-referencing through the folksonomy engine, del.icio.us. The concept is to take advantage of the superior search algorithms that are part of the del.icio.us web presence, as well as the vast cross-referencing database that is del.icio.us. The form is stored as a data collection web page built into a SQL database, which offers a robust environment for storing a wide variety of data types.

Reflection

There is a problem, and that problem is that CBR is more a retrospective tool - you need to have stories or experiences first and then it becomes appropriate to record those experiences / stories so that next time around, you'll not be starting completely fresh. For our task assignment, our needs are more prospective - we need to review content and be able to make deductions and inferences regarding our next steps.

In absence of a case to capture, an approach from the perspective of a seasoned instructional designer who would record details of training design that remains in its planning stages was taken - in this way to try to see if the 'prospective' approach was possible. (This would seem to fit the bill of capturing a 'story' or experiences.) The designer's mission is to build an introductory instructional module to teach Formative Research / Design and Development Research. The results are not robust. It was found that we had to inject into the tool what should come out as a result of using the tool (e.g., within the form can be found my rough terminal and enabling objectives).

We can see using a tool like this for capturing the results *after* conducting Formative Research / Design and Development Research projects as an aid for future researchers, but we have a difficult time considering using this approach as a task (instructional) analysis tool. In conclusion, we have difficulty seeing this approach even belonging within a book as part of a collection of instructional task analyses.

The rules of the assignment indicated we should take a task analysis approach from three different areas. Despite misgivings on using this approach, there is something to be learned from this experience. From a perspective of the importance of focus, we can see the need for quality front-end analysis that leaves the instructional designer with instructional goals. These goals point the way towards the eventual nature of the intervention, and with some knowledge of the target content, the context of the training, and the target audience, we are in a much stronger position to be able to select an appropriate task analysis method. While CBR is a valuable data collection tool, we think that it represents, in this particular context, a non-example, and as such it is as valuable as are good examples.

Analysis Comparison

The three task-analysis techniques chosen for this portfolio were based on our team's initial goal, initial terminal objective, and meeting requirements for the portfolio. We feel that the conceptual mapping technique best fit with the needs of our project. It provided the most in-depth coverage of the content although we were unable to access a human expert to elicit knowledge. The hierarchy analysis was the second best fit as it had a narrow focus limiting the amount of content which could be analyzed. CBR did not fit our needs for this project due to the nature of its analysis procedure and possible applications.

The conceptual mapping and hierarchy methods were most closely related in their sequence of steps. In terms of time, the hierarchy was the least demanding where both the CBR and conceptual mapping can lend themselves to being time consuming. Other than these instances, the three techniques differed in their focus, background, assumptions, applications, advantages, disadvantages and fit with our project. (Refer to Table 1.0).

Table 1.0: Task-Analysis Comparison Table

Category	Conceptual Mapping	Hierarchy	Case-Based Reasoning
Methodology	Subject Matter / Content Analysis (Part VI)	Instructional and Guided learning Analysis (Part III)	Cognitive Task Analysis (Part IV)
Focus	Interpret the structure of an expert's thinking to develop databases, systems, sequencing learning events, and models.	Identifying Prerequisite Skills.	Analyze Stories to solve problems, design, plan, diagnose, explain, justify, and argue.
Background	Graesser and Murachver: developed to elicit and convey knowledge from computer science experts	Gagne; to describe learning dependence among intellectual skills	Designed to explain human memory to adapt and design AI machines
Description	Nodes that represent actions, events, goals, and relationships in a graph	Identifying simple to complex hierarchy of skills	Using Schank's 'theory of memory' to address a specific need
Assumptions	Elicit knowledge through interviews, Refinement of	Learning outcome is in the intellectual skills domain,	What people know is stored as stories, Expert

Category	Conceptual Mapping	Hierarchy	Case-Based Reasoning
	conceptual graph, Knowledge can be graphed	Set of skills is already developed to master said learning outcome, Skills are ordered from simple to complex, Rationale analysis of content	index memory, Used for artificial intelligence
Procedure	6 steps (clarify graph, choose set to analyze, rough draft, follow-up, expand graph, and finalize graph) used to question experts to construct conceptual graph	9 steps (identify content, desired learning outcome, prior knowledge, pre-requisites skills) used to construct hierarchy	4 complex steps that lay out guidelines for collecting, identifying and characterizing specific criteria of stories
Applications	Wide variety of projects (ie. Selecting plants for housing & develop CBTs)	Organizing & planning instruction, Identifying content, Sequencing events	Coaching and goal-based support systems
Advantages	Highly flexible and applicable, Systematic, Graphic representation of expert knowledge	Identifies content, Identifies sequences of events, Identifies prerequisites skills focusing content	Represents human reasoning, Provides opportunity to problem solve, propose solutions, and evaluate solutions

Category	Conceptual Mapping	Hierarchy	Case-Based Reasoning
Disadvantages	Time consuming, Unstructured interview process, Best at eliciting declarative and/or conceptual knowledge	Possible lack of interconnectedness of skills, Only reflects Gagne's taxonomy, Only focuses on Intellectual skills domain	Old cases are often re-used, Cases can be seen as biased, Can become time consuming
Fit with Project	Due to its breadth and depth, it *best fit* the goals and content of our project.	Due to a lack in flexibility and insufficient scope, this technique *did not* fit the *overall goals* and objectives of the project however *it did addressed* a specific learning objective.	Due to the nature of the analysis technique it did not adequately address our project's needs. Therefore, it *did not* fit the project.

Overall Reflection

The description for this assignment suggested that making sense of the approaches to analysis could prove more difficult than implementing a particular method. We found this to be true. In this overall reflection, we discuss challenges to this sense making, the importance of an instructional goal and model, the sequence of analysis activities, the dependency on subject matter experts (SMEs), and thoughts on our next steps.

Reflecting on our process, we believe two factors challenged our sense making abilities. We believe a lack of focus early in the analysis activity and a lack of prior knowledge in the domain made our approach to task analysis difficult. We identified the lack of prior knowledge

from the start and immediately initiated a documentation analysis to elicit expert knowledge. However, without a clear focus, this knowledge elicitation was challenging.

The lack of focus was likely due to the fact that we did not attempt to clarify an instructional goal in the beginning. A good analysis seems predicated on a good goal statement. Had we been working in the context of a particular instructional model as we did in EME 6613, this situation might have been avoided. Indeed, both the Dick, Carey, and Carey (2005) and Smith and Ragan (2005) instructional models identify the clarification of a goal statement preceding analysis activities.

The Dick, Carey, and Carey (2005) and Smith and Ragan (2005) instructional models both use a two step analysis sequence. Each first proposes analyzing the goal itself to identify the major steps a learner must go through in order to accomplish the goal. Both models then perform analyses on each step identified in the goal analysis. This sequenced approach to learning task analysis might have assisted us in analysis method selection as well as in clarifying our goal.

If we had interviewed a subject matter expert during this analysis, we might have discovered the aforementioned difficulties sooner. Our relationship with the subject matter expert was limited to reading documents the experts authored. Most of the task analysis methods covered in the Jonassen, Tessmer, and Hannum (1999) book assumed a direct relationship with the subject matter expert. The content analysis methods seemed to be the only collection of task analysis methods that didn't include this assumption.

As we complete this analysis and prepare for the next stages of instructional development, we consider a new instructional goal. The results of our work to review the knowledge of this field, combined with our considerations of previously used instructional

models lead us to suggest a new goal: conduct a research study to develop or evaluate the use or validity of an instructional theory, model, product, or tool. We will consider this goal and its associated major steps as we move forward in this instructional design process.

References

Dick, W., Carey, L., & Carey, J. O. (2005). The systematic design of instruction (6th ed.). Boston, MA: Allyn & Bacon.

Ganske, L. (2007). Storytelling: The forgotten technology. *International journal of instructional media*, 34(3), 335-347.

Jonassen, D., Tessmer, M., & Hannum, W. H. (1999). Task analysis methods for instructional design. Mahwah, New Jersey: Lawrence Erlbaum Associates

Kolodner, J. (1993). *Case-based reasoning.* New York: Morgan Kaufman.

Reigeluth, C. M., & Frick, T. W. (1999). Formative research methodology for creating and improving design theories. In C. M. Reigeluth (Ed.), *Instructional design theories and models: A new paradigm of instructional theory Volume II* (pp. 631-651). Hillsdale, NJ: Lawrence, Earlbaum Associates.

Richey, R. C., & Klein, J. D. (2007). Design and development research. Mahwah, NJ: Erlbaum.

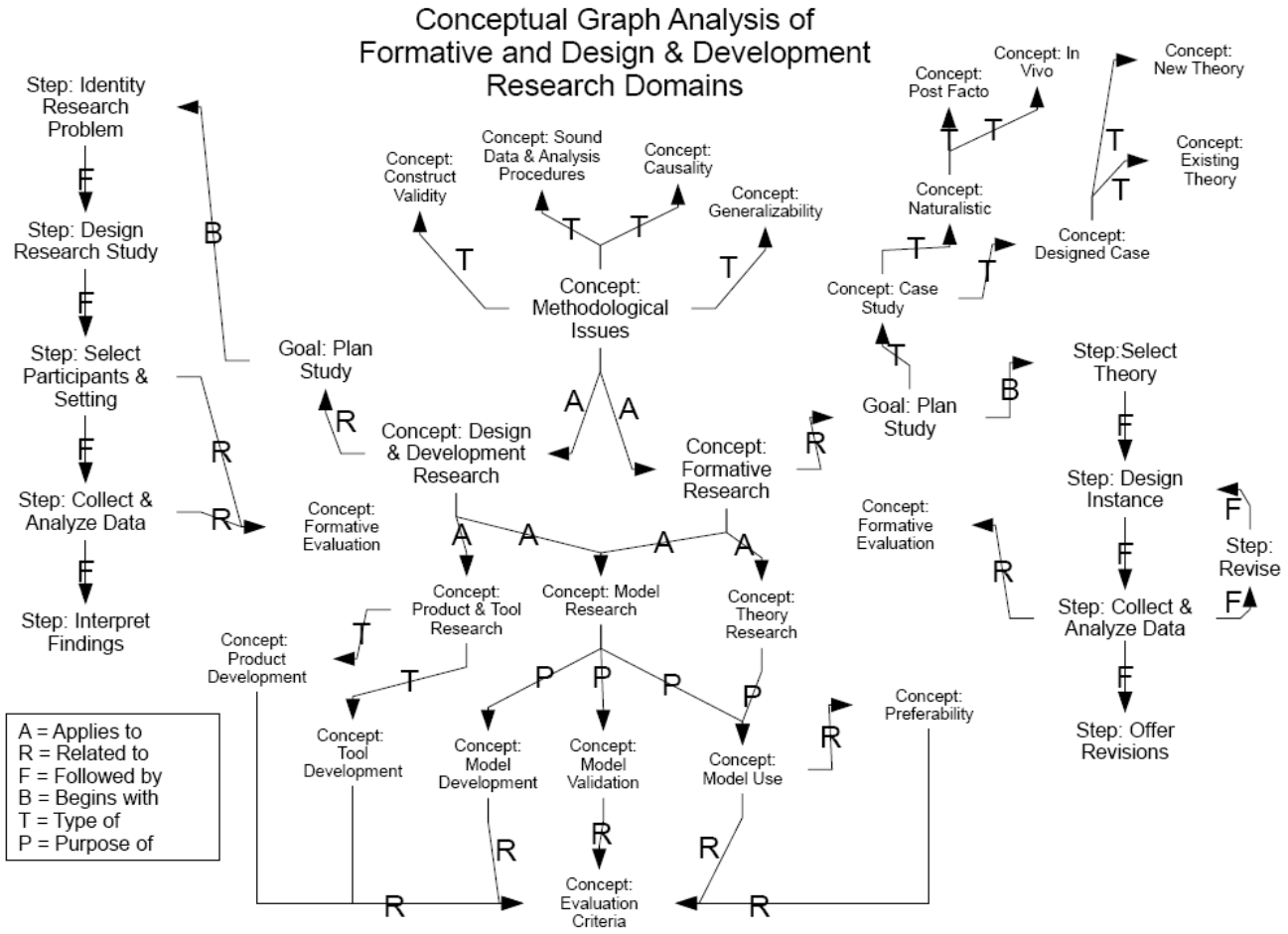
Richey, R., Klein, J. & Nelson, W. (2004). Developmental research: Studies of instructional design and development. In D.H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (2nd ed.) (pp. 1099-1130). Mahwah, NJ: Lawrence Erlbaum Associates.

Schank, R. C., Berman, T. R., & Macpherson, K. A. (1999). Learning by doing. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory Volume II* (pp. 161-181). Mahwah, NJ: Lawrence Erlbaum Associates.

Smith, P. L., & Ragan, T. J. (2005). Instructional design (3rd ed.). Hoboken, NJ: John Wiley & Sons.

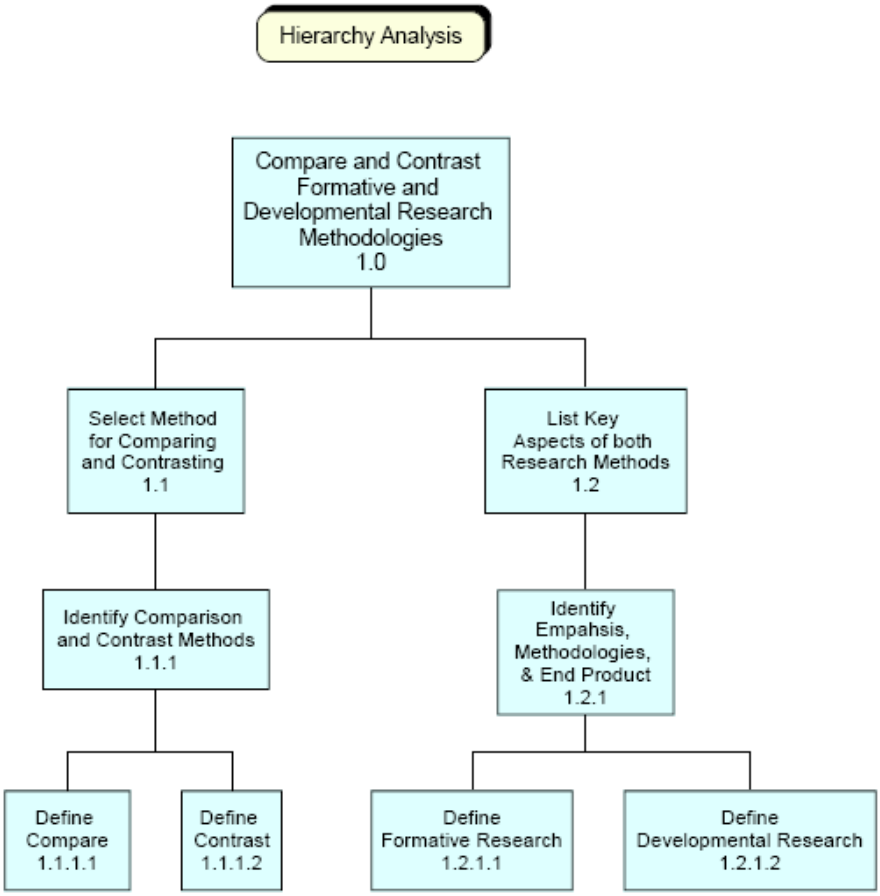
Appendix 1

Graph 1.0: Conceptual Graph Analysis



Appendix 2

Learning Hierarchy Analysis Chart



Appendix 3

Case Based Reasoning Analysis

(For the web page results, please navigate to the following URL:

http://heybradfords.com/moonlight/node/61)

Instructional Analysis: Introduction to Formative and Design and Development Research Methodologies

Submitted by bradford on Sun, 02/10/2008 - 15:51.

Goals Expectations:
Students will distinguish and explain formative and developmental research methodologies.

Context:
Doctoral students or researchers interested in learning an alternative approach to conducting research in the applied fields, such as education, where design theory is more useful and easily applied than with descriptive learning theory.

Solution:
Develop an instructional task (set of tasks) to cover in broad, general terms: a) Formative research, b) Design and development research, c) Principle of knowing the difference, d) General methodologies, e) Research applications, f) Methodological issues, g) Evaluation criteria, and h) Principle of relationship to formative evaluation.

Outcome:
Pending - this solution has not yet been implemented. Desired: Students will distinguish between formative research and design and development research and explain the general methodologies, applications, and methodological issues associated with this research.

Lessons Learned:
Pending.

Potential Tasks:
a) Quiz on differences between empirical and formative research methodologies; b) Quiz on identifying kinds of formative research methodologies; c) Essay to compare and contrast Formative vs Design and Development research methodologies.

Potential Context:
Develop knowledge base to be able to conduct similar research projects that use these methodologies.

Reasoning Goals:
With sufficient background knowledge in these methodologies, the appropriate procedures, and example case studies, a prospective researcher will be better prepared to conduct formative or design and development research.

Goals, Sub-goals, Intentions:
a) Identify the differences between traditional empirical research methodologies and formative research methodology; b) Identify different kinds of formative research studies and their respective methodologies; c) Explain through an essay the differences in Reigeluth and Frick's Formative Research focus and methodology with Richey and Klein's Developmental Research focus and methodology.

Goal Constraints:
One week time to cover salient material and complete the tasks.

Features & Relationships:
Competency, in the form of declarative conceptual, declarative rule, and some procedural knowledge, is necessary prior to engaging in this type of research. The tasks described are to gain those introductory competencies in order to fulfill the needed competencies.

Plans:
a) identify any necessary refinements to the preliminarily identified tasks; b) identify and additional resources necessary to fulfill the tasks; c) assemble detailed task instructions; d) develop assessment tools for each finalized terminal objective.

Solution Statement:
Introductory instruction to Formative Research and Design and Development Research that comprise tasks leading to general competency in the knowledge domains.

Solution Activities:
In preparation for quiz taking and essay writing, the student will review identified materials, as well as conduct additional readings, to be able to pass with satisfactory grades a quiz and an essay.

Reasoning Steps:
a) Identify the need for competency in this knowledge domain since the field of ISD is moving towards alternative methods for conducting quality research that are more closely aligned with changing learner needs and technological affordances; b) assemble appropriate training to prepare future researchers to use these methodologies.

Solution Justification:
The solution meets the needs (see the front-end analysis that justifies the instructional intervention and the reasoning steps above), fits the required schedule (1 week) of the targeted training program, and the outcomes can be measured in accordance with institutional requirements.

Results Expectations:
Students will distinguish between formative research and design and development research and explain the general methodologies, applications, and methodological issues associated with this research.

Acceptable Alternatives - Not Chosen:
a) Quiz covering all three knowledge domain areas; b) single essay to cover all three knowledge areas; c) oral presentation to the whole class.

Unacceptable Alternatives - Not Chosen:
Student reads material and participates in class discussion.

Outcome Fullfillment:
NA - Solution has not yet been delivered - Outcomes are pending.

Expectations Violation:
NA - See above

Violations/Failure Explanations:
NA - See above

Possible Repair Strategies:
NA - See above

Problem Avoidance:
NA - See above

Future Potential Solutions:
NA - See above

Feedback:
delicious: formative_research case-based_reasoning_tool instructional_analysis :: On the tool (in general): This would be an excellent vehicle to capture details of actual research projects and would become an available resource for students who would conduct research within the topic areas defined. The form requires some adjustment.