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Introduction

Instructional design theories guide designers in their work to produce instructional products or strategies. These products or outcomes should result in consistent and replicable learning events for the target audiences due to the grounded nature the theory provides the designer. It remains important that instructional designers remain current with the theories and their guiding procedures or processes and be able to identify an appropriate fit between theory and a given instructional design project. This last carries a critical implication: not only must designers stay current and be aware of different theories, but they must also be ready to know which theory will work best in a particular instructional design situation.

In this paper, we present three treatment plans that were developed by following three different instructional design theories: Mayer's *Designing Instruction for Constructivist Learning*, Schwarz, Lin, Brophy, & Bransford's *Flexibly Adaptive Instructional Designs*, and Reigeluth's *Elaboration Theory*. These three instructional design theories were applied to develop instructional plans for the same course that has the following title: *Formative Research Methodology: Foundation, Applications, Issues*. The Learning module and title for the course designs are: *Unit 1 – Foundations of Formative Research Methodology*. Each instructional plan (a.k.a., Treatment Plan) includes a detailed instructional strategy, as well as an evaluation (i.e., assessment) chart. The team designer also includes reflection notes on the application of each design theory that immediately follows the evaluation chart sections. In addition, this paper includes a comparative analysis of the final outcomes of each theory as it was applied for the instructional topic of Formative Research Methodology. Finally, the paper concludes with an

overall reflection that covers the entire team project to develop this narrative report on the application of three instructional design theories.

Designing Instruction for Constructivist Learning (Mayer, 1999)

Mayer's instructional-design theory was chosen for this assignment because we feel it lends itself well to computer-based learning environments. The SOI model developed by Mayer is used specifically for textbook, lecture and multi-media learning environments. The cognitive processes of selecting, organizing and interpreting information are used as the foundation to this model. Techniques to encourage students to become "cognitively involved" in such expository learning are provided by Mayer. Use of headings, italics, summary statements, outlines, and illustrations with captions are a few of the given techniques (Mayer, 1999).

This treatment plan fits well with the SOI model through our use of the cognitive processing methods, encouraging techniques and expository content delivery. The text includes the selecting, organizing and integrating techniques described by Mayer. We interpreted these processes by having the learners read text that includes illustrations and multimedia sources. Since the steps not necessarily sequential, all three cognitive strategies will be implemented throughout the entire unit. The recommended instructional events are 1) read the provided formative research articles, 2) complete foundations of formative research quiz, 3) review formative research plan development outline and 4) complete and submit formative research plan. Although this particular theory only describes techniques for selecting, organizing and integrating information, it does not provide additional guidance for the introduction, conclusion and assessment pieces of a module or instructional unit. Due to this it is felt that more experienced designers could easily use this theory as they could fall back on their extensive

design experience. We do not recommend a novice designer to use this theory in a solo expedition.

Terminal Objective

Given a set of instructional materials and a copy of relevant design documents, generate a formative evaluation research plan.

Enabling Objectives

Upon completion of this unit, given a set of instructional materials, Learners will be able to:

1. Identify differences between traditional empirical research and formative research;
2. Compare two types of formative research studies;
3. Identify the evaluation criteria associated with formative research;
4. Distinguish procedures for conducting formative research studies;
5. Identify and discuss methodological issues associated with formative research studies; &
6. Develop a formative research plan.

Prerequisite Skills and Knowledge

The only prerequisite skills necessary for this unit would be experience using web-based environments. The learner will need to know how to navigate through the website and communicate via the course tools (email, forums, & presentation pages). The learners will have access to Web based training on such skills via WebCT and the University technical support staff.

Instructional Strategy

The instructional strategy table (see Table 1.1) describes the sequencing of events as well as explicit directions for how the text will incorporate the cognitive processing techniques of

Mayer’s SOI model. Media to be used throughout this until consist of WebCT, web pages, PowerPoint, and graphics with captions. All media devices will be further described in the storyboarding process to provide the developer with explicit instructions.

Table 1.1. Instructional Strategy Table for SOI Model

Event	Description	Interaction	Media
<p>1.0 Cognitive Process: Selecting</p>	<p><i>Learners to be presented with an overview of the unit and importance of lesson, as well as identifies problems and limitations with failing to address related skills and/or knowledge.</i></p> <p><i>This is to further emphasize what’s in it for the learner.</i></p> <p><i>Within the text, techniques will be used to grab the learner’s attention through the use of bolding, highlighting, italicizing, underlining, captions, bulleted lists and repetition.</i></p> <p><i>Instructional objectives will be clearly stated during the lesson overview. Questions within the text will be used to further aid the learners in selecting, organizing and integrating information. A summary will be used to concisely repeat important information.</i></p> <p><i>Overall, the text will minimize irrelevant material to focus the learner’s attention.</i></p> <p>Lesson Introduction: The primary purpose of</p>	<p>Learner-Content</p> <p>Learner-Environment</p>	<p>WebCT</p> <p>Web Page</p>

Event	Description	Interaction	Media
	<p>this lesson is to help you develop a formative research plan. The lesson is important since it provides the methodological framework of formative research aiding the development of your research plan.</p> <p>Terminal Objective</p> <p>Given a set of instructional materials and a copy of relevant design documents, generate a formative evaluation research plan.</p> <p>Enabling Objectives</p> <p>Upon completion of this unit, given a set of instructional materials, Learners will be able to:</p> <ol style="list-style-type: none"> 1. Identify differences between traditional empirical research and formative research; 2. Compare two types of formative research studies; 3. Identify the evaluation criteria associated with formative research; 4. Distinguish procedures for conducting formative research studies; 5. Identify and discuss methodological issues associated with formative 		

Event	Description	Interaction	Media
	<p>research studies; &</p> <p>6. Develop a formative research plan.</p> <p>Recommended Instructional Events:</p> <ol style="list-style-type: none"> 1. Read Formative Research Articles 2. Complete Foundations of Formative Research Quiz 3. Review Formative Research Plan Development outline. 4. Complete and Submit Formative Research Plan. 		
<p>1.1 Highlighting most important information</p>	<p><i>Throughout the text bolding, highlighting, italicizing, and underlining will be used to emphasize important information.</i></p> <p>For typical research methods, validity is the main concern however for formative research the main focus is of preferability.</p>	<p>Learner-Content</p>	<p>WebCT Web Page</p>
<p>1.2 Use instructional objectives and/or adjunct questions.</p>	<p><i>All objectives will be noted in the Introduction and Overviews to the articles.</i></p> <p>Upon completion of this unit learners will:</p> <ol style="list-style-type: none"> 1. Identify differences between traditional empirical research and formative research; 2. Compare two types of formative 	<p>Learner-Content</p>	<p>WebCT Web Page</p>

Event	Description	Interaction	Media
	<p>research studies;</p> <p>3. Identify the evaluation criteria associated with formative research;</p> <p>4. Distinguish procedures for conducting formative research studies;</p> <p>5. Identify and discuss methodological issues associated with formative research studies; &</p> <p>6. Develop a formative research plan.</p>		
1.3 Provide a summary	<p><i>A summary will conclude the articles, tying in all relevant and important information.</i></p> <p>In conclusion, formative research is concerned with the <i>effectiveness, efficiency, and appeal</i> of each design rather than the design's validity.</p>	Learner-Content	WebCT Web Page
1.4 Eliminate irrelevant information; be concise	<p><i>In the entire unit, the text will minimize irrelevant material to focus the learner's attention. Reduce scenarios and story-based text to focus the information on concrete aspects of formative research.</i></p>	Learner-Content	WebCT Web Page
2.0 Cognitive Process: Organizing	<p><i>Information will be structured within the text using outlines and headings to organize the content. Signal words (ie. Step1, Step2, Step3) will be incorporated throughout the text</i></p>	Learner-Content Learner-Environment	WebCT Web Page

Event	Description	Interaction	Media
	<p><i>to organize sequential knowledge. Graphics will be used with captions to visually organize information.</i></p>		
<p>2.1 Structure of text</p>	<p><i>The use of analogies and cause/effect comparison techniques will be used to help structure the text.</i></p> <p>For typical research methods, validity is the main concern however for formative research the main focus is of perferability.</p>	Learner-Content	<p>WebCT</p> <p>Web Page</p>
<p>2.2 Outlines</p>	<p><i>Specific use of outlines will be used throughout text to organize content into coherent steps.</i></p> <p>For typical research methods, validity is the main concern however for formative research the main focus is of perferability. This is further broken down into three dimensions.</p> <ol style="list-style-type: none"> 1. Effectiveness 2. Efficiency 3. Appeal 	Learner-Content	<p>WebCT</p> <p>Web Page</p>
<p>2.3 Headings</p>	<p><i>Headings will be used throughout text to help distinguish and focus the content.</i></p> <p>Article Outline:</p> <p>Introduction to Formative Research</p>	Learner-Content	<p>WebCT</p> <p>Web Page</p>

Event	Description	Interaction	Media
	<p>Traditional versus Formative Research</p> <p>Types of Formative Research</p> <p>Methodological Issues</p>		
<p>2.4 Signal words</p>	<p><i>Signal words will be used to bring structure to content.</i></p> <p>In a Design Case research study the process used to improve an existing theory are step 1) select a theory, step 2) design an instance of a theory, step 3) collect and analyze formative data on the instance, step 4) revise the instance, step 5) repeat the data collection and revision cycle and step 6) offer tentative revisions for the theory.</p>	<p>Learner-Content</p>	<p>WebCT</p> <p>Web Page</p>
<p>2.5 Graphic presentations</p>	<p>A PowerPoint presentation will be developed that incorporates the context with real-time narration.</p>	<p>Learner-Content</p> <p>Learner-Environment</p>	<p>WebCT</p> <p>Web Page</p> <p>PowerPoint Presentation</p>
<p>3.0 Cognitive Process: Interpreting</p>	<p>In order to promote linking new acquired information to prior knowledge for the purposes of encoding into long-term memory, the following techniques will be used throughout the text: advanced organizers (The use of analogies and cause/effect comparison</p>	<p>Learner-Content</p> <p>Learner-Environment</p>	<p>WebCT</p> <p>Web Page</p>

Event	Description	Interaction	Media
	<p>techniques will be used to clarify information to promote the learner's knowledge acquisition), graphics with captions, PowerPoint presentations with narration, examples, and questions.</p>		
<p>3.1 Advance organizers</p>	<p><i>Analogies and Comparison and Contrast techniques will be used to help link to a learner's prior knowledge.</i></p> <p>The third dimension, appeal, is related to how enjoyable a design is for someone. Although this is independent of the other dimensions, it is just as important. Without considering a learner's enjoyment, the most effective and efficient designs could have little impact on the learner.</p>	<p>Learner-Content</p>	<p>WebCT Web Page</p>
<p>3.2 Illustrations with captions</p>	<p>Illustrations will include coordinating captions to provide extra guidance for learners.</p>	<p>Learner-Content</p>	<p>WebCT Web Page Illustrations</p>
<p>3.3 Animation with narration</p>	<p>A PowerPoint presentation will be developed that incorporates the context with real-time narration.</p>	<p>Learner-Content Learner-Environment</p>	<p>WebCT Web Page PowerPoint Presentation</p>
<p>3.4 Worked out</p>	<p><i>Formative research examples will be</i></p>	<p>Learner-Content</p>	<p>WebCT</p>

Event	Description	Interaction	Media
examples	<p><i>incorporated into the articles and articles will be provided for supplemental reading</i></p> <p>List of Supplemental Reading:</p> <ul style="list-style-type: none"> ● Formative Research on the Heuristic Task Analysis Process (Lee & Reigeluth, 2003) ● Formative Research Activities To Provide Web-Based Nutrition Education to Adults in the Upper Rio Grande Valley (Buller et. Al, 2001) ● Formative Research on Sequencing Instruction with the Elaboration Theory (English & Reigeluth, 1995) 		Web Page
3.5 Elaborative questions	<p><i>Questions throughout text will be posted to promote knowledge acquisition.</i></p> <p><i>To be used for in the 'appeal' section: How much did you enjoy the lectures in your college classes?</i></p>	Learner-Content	WebCT Web Page

Media Selection Rationale

Web Pages were selected to deliver most instructional events for a number of reasons:

- First and foremost, the primary goal of the chosen theory dictates the use of text-based materials. Text books, lectures and multimedia resources are the key sources of

information. These are then modified by best practices techniques to elicit knowledge acquisition.

- The assumed context analysis indicated that the course is to be delivered via the Internet as determined by the University. As such, the WWW provides the most accessible means of providing a combination of text and graphics.
- The content and learning objectives for this lesson is primarily focused on the acquisition and use (e.g., discussion) of verbal information. As such, the use of text and graphics are most essential which the WWW supports in an effective manner, particularly with the availability of using hypertext links.
- No face-to-face interaction is necessary for the selected events.
- Learners may be located anywhere across the United States and around the world, and may decide to take the course while at work, at home or somewhere in the community with Internet access. Therefore, the WWW provides the most economic means of providing access to the instruction.
- Sufficient resources are available to create an interactive and attractive website (e.g., funds are available to hire a Web programmer and graphic artist).
- The university already owns the course delivery system (WebCT) that is to provide access to the Web pages so there is no need for any additional financial resources.

Discussion boards and web site/pages were selected for posting learners' assignments and discussions because:

- It allows learners to control when they work on and post their assignments (asynchronous communications).
- It allows learners in remote locations to readily access classmates' drafts.

- No face-to-face interaction is necessary.
- Discussion boards allow for a centralized communication point for all learners within the same course.
- It gives the learners opportunities to communicate the learned skills/knowledge with peers.

Evaluation Chart – Constructivist Learning

The evaluation chart (see Table 1.2) displays the alignment of objectives with the specific assessment items. The domain and methodology are used to further explicate the importance of this alignment between objective and assessment. An example quiz and rubric are attached within the Appendix 1, as a means to provide additional clarity to the treatment plan.

Table 1.2. Evaluation Chart for SOI Model

Knowledge/Skill	Objective	Domain	Method	Item/Criteria
Identifying differences in research methodologies	Given a set of instructional materials, Identify differences between traditional empirical research and formative research	Verbal Information	Post Test: Multiple Choice	Intention to improve theoretic design, instructional resources and curricula are characteristics of formative research. True/False
Comparison of types of research	Given a set of instructional materials, Compare two types of formative research studies;	Verbal Information	Post Test: Multiple Choice	Which of the following are types of formative research? a. Designed Case b. In Vivo/Post Facto Naturalistic Case c. Both A & B

Knowledge/Skill	Objective	Domain	Method	Item/Criteria
				d. None of the above
Identifying evaluation criteria	Given a set of instructional materials, Identify the evaluation criteria associated with formative research;	Verbal Information	Post Test: Multiple Choice	What are the three dimensions of the preferability evaluation criteria of formative research? a. Appeal, Effectiveness, & Efficiency b. Appeal, Efficiency, & Validity c. Effectiveness, Efficiency & Validity d. Appeal, Effectiveness, & Validity
Distinguishing procedures	Given a set of instructional materials, Distinguish procedures for conducting formative research studies	Verbal Information	Post Test: Multiple Choice	Which of the following is <i>not</i> a procedure for formative research on an <i>existing theory</i> ? a. selecting a design theory b. create a case to help you generate the design theory c. revise the instance d. offer tentative revisions for the theory
Identifying methodological issues	Given a set of instructional materials, Identify and discuss	Verbal Information	Post Test: Multiple	Construct validity, sound data collection and attention to generalizability are key issues of

Knowledge/Skill	Objective	Domain	Method	Item/Criteria
	methodological issues associated with formative research studies		Choice	formative research. True/False
Develop research plan	Given a set of instructional materials, Develop a formative research plan	Problem Solving	Post Test: Rubric	<ul style="list-style-type: none"> • Identification of clear, concise overview with instructional purpose, audience and context. • Identification and justification of purpose statement • Complete, clear and concise formative research plan including all specified areas (background, purpose, subjects, design, instruments, procedures, protocols, reflection, results and discussion) • Complete, clear and concise descriptions of methods used • Instruments used are

Knowledge/Skill	Objective	Domain	Method	Item/Criteria
				<p>well designed and address purpose of plan</p> <ul style="list-style-type: none"> • Identifies and discusses methodological issues of formative research • Provides a reflection including recommendations, limitations and constraints faced during the development of research plan. • Posted correctly to presentation area • Posted on or before specified due date • Report well-formatted and presented in professional manner, controlling for surface features with little to no grammatical errors.

Reflection on the Mayer- SOI Model

The model is a great way to incorporate strategies for expository learning resources however it does not provided guidance on the organization for an introduction, conclusion and assessment portions of a module/lesson. Due to this it caused a little anxiety, in trying to makes sure these sections fit within the constructivist model. Even noting this we feel that it is a great way to utilize constructivist methods with text-based learning environments. As the educational system is currently using textbooks and lectures as main sources of information, this method could aid student's knowledge acquisition without having to change pedagogical practices all together. It has great potential however it seems to be heavily reliant on the developers of such text-based resources. Thus, text-book publishers should consider the use of this model when developing their own products. This could impact their use within classrooms further enhancing a learner's experience. We also feel that web-based learning environment developers should take these cognitive processes into consideration. The use of text, lecture and multi-media for learning are used extensively through the internet.

The SOI Model meshes well with the overall goals of our perceived end product. It provides guidance for the use of the cognitive processing methods, encouraging techniques and expository content delivery. We interpreted these processes by having the learners read text that includes illustrations and multimedia sources. Although this particular theory focuses on techniques for selecting, organizing and integrating information, it does not provide additional guidance for the introduction, conclusion and assessment pieces of a module or instructional unit. With this lack of attention, it makes these sections appear to have little relevance to the cognitive processing that occurs during a lesson. Since these sections are typically found in educational materials, we feel that it is important to include them within our unit. Due to the lack of attention to these sections, we felt that the theory is could be more easily employed by

experienced designers; as they could fall back on their extensive design experience. Hence, we do not recommend a novice designer to use this theory in a solo expedition.

Flexibly Adaptive Instructional Designs: Schwarz, Lin, Brophy, & Bransford (1999)

The Schwartz, Lin, Brophy, and Bransford instructional design theory is the basis for the instructional treatment plan and evaluation chart below. The key events in the strategy are used to help motivate interest in students early in the process (i.e., look ahead and look back binoculars, initial challenges, and the generation of ideas). Two inquiry cycles are used. The first inquiry cycle focuses on naturalistic case study approaches to formative research. The second inquiry cycle focuses on designed case study approaches to formative research. Evaluation is focused on the two test your mettle events and the final general reflection. While Schwartz et al. encouraged self reflection, this implementation assumes an instructor will evaluate the written reflection.

Terminal Objective

- Given a set of instructional materials and a copy of relevant design documents, generate a formative evaluation research plan.

Enabling Objectives

- Identify differences between traditional empirical research and formative research;
- Compare two types of formative research studies (i.e., Designed Case and Naturalistic Case);
- Distinguish procedures for conducting formative research studies;
- Identify the evaluation criteria associated with formative research (i.e., effectiveness, efficiency, and appeal); and

- Identify and discuss methodological issues associated with formative research studies

Prerequisite Skills and Knowledge

It is assumed that learners have prerequisite knowledge of formative evaluation techniques as used in an instructional design model. It is also assumed that learners have prerequisite knowledge of quantitative and qualitative research methods.

Instructional Strategy

Table 2.1 below represents an instructional treatment plan for a unit on formative research using the Flexibly Adaptive Instructional Theory posited by Schwartz, Lin, Brophy, and Bransford (1999). The key instructional events outlined in the theory are placed on the left most column. For each event, a description of the event is given along with the types of interactions and anticipated media formats.

Table 2.1. Instructional Treatment Plan using Flexibly Adaptive Instructional Theory

Event	Description	Interaction	Media
Look ahead and reflect back binoculars	<p>Develop an introductory narrative that introduces formative research based on Reigeluth and Frick (p. 636) and Richey and Klein (Chapter 1).</p> <p>Pose examples of research problems formative research can address based on those introduced by Reigeluth and Frick (p. 636) and Richey and Klein (Chapter 2).</p>	Learner-content	HTML
Beginning of inquiry cycle 1: in vivo naturalistic case for an existing theory			

Event	Description	Interaction	Media
Initial challenge	<p>Present a scenario where Dr. Adams would like to improve his theory that Mr. Smith uses in his classroom.</p> <p>How might we help evaluate the instructional theory using Mr. Smith's class?</p>	learner-content	HTML
Generate ideas	<p>Post ideas for how you might approach completing the challenge</p> <p>Comment on 2 classmates ideas</p> <p>Form teams</p>	Learner-interface, learner-learner	WebCT discussion board
Multiple perspectives	<p>Provide links to:</p> <p>Distinguish between formative research and other research methods (Reigeluth and Frick, pp. 633-634; Richey and Klein, p. 14)</p> <p>Describe situations when a naturalistic case study is appropriate (Reigeluth and Frick, pp. 637 & 645-646)</p> <p>Describe procedures associated with naturalistic case study (Reigeluth and Frick, pp. 638 & 645-646)</p>	learner-content	HTML Books

Event	Description	Interaction	Media
	<p>Describe the evaluation criteria (Reigeluth and Frick, pp. 634-636)</p> <p>Describe the methodological issues for formative research (Reigeluth and Frick, pp. 647-649; Richey and Klein, pp. 123-124, 139-141, 78-80, 94-95, 61-62, 36-38)</p>		
Research and revise	<p>As a team, begin developing your evaluation method while reviewing the following resources:</p> <p>Provide links to specific case studies: Khan (1994) and Wang (1992) and previous legacies</p> <p>Introduce concept of post facto case and highlight distinctions in methodologies (Reigeluth and Frick, pp. 645-646)</p> <p>Describe the differences between developing a new theory vs. attempting to improve an existing theory (Reigeluth and Frick, p. 645)</p> <p>Individually, compare and contrast examples to your initial ideas and post responses</p>	Learner-learner, learner-content, learner-interface	WebCT discussion board HTML Books Articles

Event	Description	Interaction	Media
Test your mettle	<p>Post your plan for responding to the challenge and be sure to identify issues that will require attention in your plan</p> <p>Comment on 2 other teams</p> <p>Revise your plan based on instructor input and peer input</p> <p>Post revision</p>	Learner-learner, learner-interface	WebCT discussion board
Go public	Develop a legacy (tips and ideas) for future students	Learner-learner	WebCT presentation pages
End of inquiry cycle 1			
Beginning of inquiry cycle 2: designed case for an existing theory			
Initial challenge	<p>Present a scenario where Dr. Adams now has a small budget to carry out a study to evaluate his theory.</p> <p>How might we go about evaluating an existing theory given our budget?</p>	learner-content	HTML
Generate ideas	<p>Post ideas for how you might approach completing the challenge</p> <p>Comment on 2 classmates ideas</p> <p>Form teams</p>	Learner-interface, learner-learner	WebCT discussion board
Multiple perspectives	Provide links to:	learner-content	HTML

Event	Description	Interaction	Media
	<p>Describe situations when a designed case study is appropriate (Reigeluth and Frick, p. 637)</p> <p>Describe procedures associated with naturalistic case study (Reigeluth and Frick, pp. 638 & 639-644)</p>		<p>Books</p>
<p>Research and revise</p>	<p>As a team, begin developing your evaluation method while reviewing the following resources:</p> <p>Provide links to specific case studies: English (1992), Kim (1994), Roma (1990), Simmons (1991), Clonts (1993), Armstrong (1993), and Shon (1996)</p> <p>Provide links to previous legacies</p> <p>Describe the differences between developing a new theory and attempting to improve an existing theory (Reigeluth and Frick, pp. 644-645)</p> <p>Individually, compare and contrast examples to your initial ideas and post responses</p>	<p>Learner-learner, learner-content, learner-interface</p>	<p>WebCT discussion board</p> <p>HTML</p> <p>Books</p> <p>Articles</p>

Event	Description	Interaction	Media
Test your mettle	Post your evaluation method and identify limitations post to individual/group pages and comment on 2 other teams revise post revision	Learner-learner, learner-interface	WebCT discussion board
Go public	Develop a legacy (tips and ideas) for future students	Learner-learner	WebCT presentation pages
End of inquiry cycle 2			
General reflection and decisions about legacies	Review the look ahead and reflect back binoculars Comment on the benefits and limitations of each legacy Write a reflection paper that describes what you have learned about formative research. Be sure to: <ul style="list-style-type: none"> ● Distinguish between formative research and other research methods ● Compare and contrast naturalistic and designed case studies. ● Describe evaluation criteria 	Learner-content, learner-interface	WebCT discussion board HTML

Event	Description	Interaction	Media
	associated with formative research		

Evaluation Chart – Flexibly Adaptive Instructional Designs

Table 2.2 below represents an evaluation chart for a unit on formative research. This evaluation chart ensures an alignment between objectives and assessments. For each objective, guidance on the assessment methodology is given.

Table 2.2. Evaluation Chart based on the Flexibly Adaptive Instructional Theory

Knowledge/Skill	Objective	Assessment
Develop a formative research plan	Given a set of instructional materials and a copy of relevant design documents, generate a formative evaluation research plan.	Based on completion of EO assessments
Identify differences between traditional empirical research and formative research	Identify differences between traditional empirical research and formative research;	General reflection rubric: identifies the focus of traditional quantitative and qualitative research on “what is” vs. the formative research focus on “how to do”.
Compare two types of formative research studies (i.e., Designed Case and Naturalistic Case)	Compare two types of formative research studies (i.e., Designed Case and Naturalistic Case);	<i>General reflection rubric:</i> clearly describes situations where each type of study is most appropriate clearly describes limitations associated with each

Knowledge/Skill	Objective	Assessment
Distinguish procedures for conducting formative research studies	Distinguish procedures for conducting formative research studies	<p><i>Test your mettle 1 rubric:</i></p> <p>clearly describes the steps involved in a naturalistic case study</p> <p><i>Test your mettle 2 rubric:</i></p> <p>clearly describes the steps involved in a designed case study</p> <p><i>General reflection rubric:</i></p> <p>clearly identifies differences between naturalistic and designed case study procedures</p>
Identify the evaluation criteria associated with formative research (i.e., effectiveness, efficiency, and appeal)	Identify the evaluation criteria associated with formative research (i.e., effectiveness, efficiency, and appeal)	<p><i>General reflection rubric:</i></p> <p>clearly distinguishes between validity and preferability as major research concerns</p> <p>clearly describes the meaning of effectiveness, efficiency, and appeal</p>
Identify and discuss methodological issues associated with formative research studies	Identify and discuss methodological issues associated with formative research studies	<p><i>Mettle 1 and 2 should include:</i></p> <p>Description of methodological issues associated with formative research (i.e., construct validity, data collection and analysis procedures, and generalizability)</p>

Reflection on the Flexibly Adaptive Design Theory

This theory strongly encourages the designer to adapt the instruction to the learner. The initial focus on motivation and a representative problem challenges the designer to capture the interest of the learner. Rather than simply providing content to the learner, the initial challenge event requires the designer to think about the material in a manner that is relevant to the learner. This was a rewarding process. The progressive deepening of multiple inquiry cycles frees the designer to consider this relevance at multiple levels. The strategy seemed to live up to its name of being flexibly adaptive, yet based on grounded theory.

I did find the theory somewhat at odds with traditional assessment methods. While there is a key “test your mettle” event in each inquiry cycle that allows the learner to be assessed, I found that Schwartz, Lin, Brophy, and Bransford seemed to encourage learner self-reflection and revision rather than external testing and ranking.

Often, students do not have a chance to see just how much they have learned. Consider graduate education. Grades do not give students a chance to perceive their own knowledge growth in any direct way. Comparisons to peers do not work well because one and one's peers could both move forward, and therefore one might never know there was a change. Furthermore, comparing oneself against a mentor such as a professor does not work very well because the contrast can be too great. Often times, it is a self-comparison that makes students realize how much they have learned. For example, by rereading an article after some time, most students are heartened by their discovery of how much more they can see in the article (pp. 206-207).

At the end of the day however, it seems a grade is needed and the revisions must come to an end. Thus, I found myself modifying the events, particularly the general reflection event at the end of the strategy in an effort to include assessments that an instructor can evaluate.

Elaboration Theory: Reigeluth (1999)

Reigeluth's Elaboration Theory was used to guide the design of an introductory course on Formative Research Methods. Reigeluth himself describes that the Elaboration Theory fits well for guiding the design of holistic sequences that "...makes the learning process more meaningful and motivational to learners" (Reigeluth, 1999, p. 428). As discussed in a previous paper, the Elaboration Theory includes a focus on learner-centered instructional design that works equally well in all of the *focus of learning* quadrants. The scope and sequence of instructional content that should emerge from a design that follows the Elaboration Theory will be rich in relevance, recognition, and motivation for the learner.

For instructional situations that cover complex cognitive tasks, such as learning and later applying Formative Research methods, the Elaboration Theory is well matched: "Regarding cognitive structures (understanding), the elaboration sequences help to build the cognitive scaffolding that makes subsequent, more complex understandings much easier to attain, through either directive or constructivist approaches to instruction. Therefore, this sequencing strategy also results in the formation of stable cognitive schemata to which more complex understandings are more easily added" (Reigeluth, 1999, p. 433). The Elaboration Theory is founded on the idea that the different relationships within the instructional content require different sequencing strategies, and that "...different relationships are important for different kinds of expertise" (Reigeluth, 1999, pp. 434-435).

Learning about or mastering Formative Research Methods requires a learner to explore both *task expertise* and *domain expertise*, which in Reigeluth's view are distinct from procedural or declarative knowledge (Reigeluth, 1999, p. 435). For task expertise, Reigeluth identifies that tasks will range from simple to complex and that the Elaboration Theory is intended for the more complex tasks, which require that they are done differently under different conditions. These

conditions define different versions of the task, and some of those versions are much more complex than others. Formative Research methods have been applied in a variety of different situations for a variety of disciplines, and while the research method includes a generalized procedure, there will likely be some variations to the procedure arising from all the variety. Designing an instructional unit on Formative Research Methods by following the Elaboration Theory should include preparation for such potential variety. Reigeluth also identifies that domain expertise will range from simple to complex, as well as from general (broad) to detailed. For such design applications, the elaboration sequence will start with the broadest, most inclusive, most general ideas and progress to more complex and precise ideas. Since the prerequisite knowledge or skill for the introductory course in Formative Research Methods does not assume prior mastery of any other research methodology, the holistic approach directed by the Elaboration Theory requires that the initial, foundation course, be broad, while providing context. With this design guideline in mind, the following text presents an initial analysis of the content to be learned by applying the Elaboration Theory, followed with an instructional strategy that will function as a treatment plan to guide development of the instructional unit and an evaluation chart to guide development of the assessment tools.

Finally, the reader needs to be made aware that by following the design process guided by Reigeluth's Elaboration Theory, three distinct instructional units (in Reigeluth's terms, "episodes") were identified. This treatment plan only includes the design analysis and guidelines for the first unit. The remaining units would need to be covered in separate treatment plans.

Terminal Objective

Students will distinguish formative research methodology from other research methodologies and explain the methodologies, applications, and issues associated with formative research.

Enabling Objectives

Having received the instructional unit on Formative Research Methodologies, do the following:

- Prepare to take the educational unit on Formative Research Methodologies by reviewing the assignment instructions and due dates for deliverables, and by contacting the instructor for any necessary clarifications within one day of receiving the assignment

Having completed the text book and supplemental reading assignments, do the following by successfully completing a quiz, reviewing the score, revisiting the readings to correct any mistakes (if needed), and then retaking the quiz a second time to improve the score:

- Identify the differences between traditional empirical research methodologies and formative research methodology
- Identify different kinds of formative research studies and their respective methodologies

In preparation for writing a comparative essay on research methodologies, use the material from the readings, as well as use library or other research resources to complete the following before or on the assignment's due date:

- Locate material of suitably respectable academic quality that provides answers or explanations to each of the topic areas generated in the questions
- Cite your references that you will use in your essay following the APA style guide

Using the material from the readings and by using library or other research resources complete the following before or on the assignment's due date:

- Compare and contrast through an essay Reigeluth and Frick's Formative Research focus and methodology with empirical research methodologies, such as Quantitative or Qualitative approaches
- Through the same essay, identify and elaborate on issues associated with Formative Research methodologies by using references that clearly demonstrate research and study of the methodology beyond information found in the course textbook

Prerequisite Skills and Knowledge

The prerequisite skills and knowledge necessary to take this unit lesson include the following: the learner needs to be either a doctoral-level student (and all that this implies in the way of knowledge, skills, and experience) in education or a graduate level researcher in education who is 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 theories.

Planning the Instructional Sequence with Reigeluth's Elaboration Theory

The objective of the Elaboration Theory is to "...provide a holistic alternative to the parts-to-whole sequencing and superficial coverage of content that have been so typical of both education and training over the past five to ten decades" (Reigeluth, 1999, p. 434). The Elaboration Theory was used to plan the instructional units (see below Table 3.1. Design Plan with Reigeluth's Elaboration Theory). By first creating a guide that presents the steps and details of the Elaboration (see the left-hand column in Table 3.1 – ISD Planning Event), and then working with the targeted instructional content, the sequences, as well as successive, and

preceding, instructional units can be readily identified and fitted appropriately into the table (see the right-hand column in Table 3.1 – Unit Application Notes).

Table 3.1. Design Plan with Reigeluth’s Elaboration Theory

ISD Planning Event	Unit Application Notes
<p>Phase I: Prepare for Analysis and Design</p> <ul style="list-style-type: none"> ● Determine if the sequence best fits a Conceptual Elaboration sequence ● Or is the best fit a Theoretical Elaboration sequence ● Or can the Simplifying Conditions Method (SCM) be a best fit 	<p>Conceptual Elaboration Sequence is the best fit. Rationale:</p> <p>Formative Research Methodologies does incorporate a sequenced procedure (i.e., tasks), but the terminal objective for this unit is to achieve and demonstrate an understanding between conceptual content. A later unit that incorporates practice of the Formative Research Methodology might use the SCM.</p>
<p>Step 1: Preparation</p> <ul style="list-style-type: none"> ● Establish rapport with the SME ● Identify the characteristics of the conceptual/theoretical/task elaboration sequence ● Identify the characteristics of the learners in general ● Identify the delivery constraints of the instruction in general 	<ul style="list-style-type: none"> ● Available SME resources: Dr. Hirumi and Dr. Reigeluth ● Formative Research Methodology is a subset of research methodologies – distinguished by its prescriptive and cycles of successive improvement (adjustment) – and different sequences depending on the nature of the theory being researched ● Doctoral students or researchers interested in an alternative methodology to conduct research that will yield successively improved prescriptive theory ● Unit delivery should work through an online course model and should be completed within one and one and-a-half week’s worth of a study term
<p>Phase II: Identify the First Learning Episode</p>	
<p>Step 2: Simplest version</p> <ul style="list-style-type: none"> ● Identify some major task versions and their conditions ● Ask SME to recall the simplest version – check if it’s representative 	<p>Broad to ever more narrow and more detailed:</p> <ul style="list-style-type: none"> ● What are several research methodologies? ● What are their distinguishing characteristics? ● What is Formative Research Methodology?

ISD Planning Event	Unit Application Notes
	<ul style="list-style-type: none"> ● What are different forms of Formative Research and when are they best used? ● What are some examples of research conducted using Formative Research Methodology? ● What are the advantages / disadvantages of using Formative Research methods? ● What issues are associated with Formative Research Methodologies?
<p>Step 3: Organizing content</p> <ul style="list-style-type: none"> ● If procedural, do a procedural task analysis to identify substeps ● If heuristic, identify guidelines and decision rules in a performance model and identify explanations in explanatory models ● If both, do both 	<p>Follow the general guideline outlined above: from broad and most inclusive to increasingly narrow and less inclusive with more details until the necessary level of detail has been reached</p>
<p>Step 4: Supporting content</p> <ul style="list-style-type: none"> ● Identify information, understandings, skills, metacognitive / higher order thinking skills that are relevant to this version and not yet acquired by the learners ● Analyze those understandings, skills, etc down to entry level 	<ul style="list-style-type: none"> ● Describe what qualifies as research and its purpose, as well as the general characteristics of researchers – their level of education and their general need for a research methodology ● Identify several research methodologies that are not Formative Research ● Describe their respective purposes and general areas of application ● Reflect and describe derived advantages / disadvantages, as well as any issues ● Describe the purpose and general area of application of Formative Research
<p>Step 5: Size</p> <ul style="list-style-type: none"> ● Decide how big your episodes should be – class time 	<ul style="list-style-type: none"> ● Episode should comprise a two-week span of a university using the semester term format – universities on the quarter / trimester term format will require a foreshortening of the

ISD Planning Event	Unit Application Notes
<p>blocks, in-class and homework time, not too big, nor too small, “pay-off” is commensurate with learner time invested</p> <ul style="list-style-type: none"> ● Adjust the size of the episode to the target size 	<p>episode, which can be achieved by requiring less reading and a shorter, less detailed final product outcome</p> <ul style="list-style-type: none"> ● Learner will receive initial instructions and the assignment at the beginning of the episode and will deliver the final product outcome within two weeks from the assignment delivery
<p>Step 6: Within-episode sequence</p> <ul style="list-style-type: none"> ● Teach prerequisites just prior to content for which they are prerequisites ● Teach understanding prior to a related procedure ● Teach coordinate concepts together ● Teach content in the order in which it is used 	<p>See steps 2 – 5 and follow a broad to narrow and detailed level by the conclusion of the study unit</p>
<p>Phase III: Identify the Next Learning Episode</p>	
<p>Step 7: Next version</p> <ul style="list-style-type: none"> ● Identify and rank-order all simplifying conditions that distinguish the simplest to the more complex versions ● Identify the next simplest and most representative version 	<p>Unit 2 should comprise the following:</p> <ul style="list-style-type: none"> ● Conduct a brief general survey of Formative Research projects, with attention paid to the nature / characteristics of the projects and any associated issues that arose, how long the projects have been running etc. ● Conduct a narrow survey of Formative Research projects within the area of the learner’s interests or specializations – learner should establish communication with practitioners to supplement the learner’s inexperience with the practice and augment the learner’s chance of success
<p>Step 8: Organizing content, supporting content, size, and within-episode sequence</p>	
<p>Step 9: Remaining versions</p>	<p>Unit 3 should comprise the following:</p> <ul style="list-style-type: none"> ● Develop a research plan for conducting a Formative Research project

Instructional Strategy

Outlined below in Table 3.2., we have the instructional strategy, which presents the design details for Unit 1 - Foundations of Formative Research Methodology. From this descriptive table, instructional developers have considerable detail from which they will be guided in their development efforts for this instructional unit.

Table 3.2. Instructional Strategy

Primary Instructional Objectives	Instructional Events	Descriptions	Interactions & Secondary Enabling Objectives	Media
<p>Having received the instructional unit on Formative Research Methodologies:</p> <ul style="list-style-type: none"> ● Prepare to take the educational unit on Formative Research Methodologies (1) by reviewing the assignment instructions and due dates for deliverables, and (2) by contacting the instructor for any necessary clarifications within one day of receiving the assignment 	<p>Problem Solving (Presentation of the problem and problem space):</p> <ul style="list-style-type: none"> ● Receive assignment ● Review assignment and request clarifications 	<p>Assignment:</p> <ol style="list-style-type: none"> 1. Review assessment rubric and examples prepared for this assignment (below). 2. Review the Course Schedule and note due dates for the assignment. Also, be sure to monitor Webcourses@UCF course calendar for any changes to dates. 3. Reflect on the goals, objectives, and context of the unit. Request assignment clarifications from your instructor if needed. 	<p>Learner-content:</p> <ul style="list-style-type: none"> ● Navigate to website that contains the assignment instructions ● Review the assignment details and due dates <p>Learner-instructor</p> <ul style="list-style-type: none"> ● Request (if necessary) clarification of any assignment details, due dates, grading expectations, or reading materials 	<ul style="list-style-type: none"> ● Web page / Webcourses @UCF ● Email

Primary Instructional Objectives	Instructional Events	Descriptions	Interactions & Secondary Enabling Objectives	Media
<p>Having completed the text book and supplemental reading assignments:</p> <ul style="list-style-type: none"> ● Identify the differences between traditional empirical research methodologies and formative research methodology ● Identify different kinds of formative research studies and their respective methodologies <p>By successfully taking a quiz, reviewing the score, revisiting the readings to correct any mistakes (if needed), and then retaking the quiz a second time to improve the score.</p>	<p>Concepts (Expository approach):</p> <ul style="list-style-type: none"> ● Do text book readings ● Do supplemental readings (if appropriate) ● Take online quiz 	<p>4. Read the selected chapter in your course text book. Read the supplemental material located online:</p> <ul style="list-style-type: none"> ● Maricopa.edu – online overview and review tool ● Case studies 1 , Case studies 2 , Case studies 3 ● Center for psychology resources ● Qual Page ● Methods in Behavioral Research – Cozby, CSUF <p>5. Take the quiz. Review your results and reread the reading materials as appropriate. You may retake the quiz</p>	<p>Learner-content:</p> <ul style="list-style-type: none"> ● Navigate to the website with the unit lesson ● Review text book reading chapter assignment(s) and read the material ● Review supplemental reading assignment(s) and read the material <p>Learner-interface</p> <ul style="list-style-type: none"> ● Navigate to the website with the unit quiz ● Take and complete online quiz ● Review the score and learn where understanding is lacking ● Retake the quiz to improve the score 	<ul style="list-style-type: none"> ● Web pages / Webcourses @UCF

Primary Instructional Objectives	Instructional Events	Descriptions	Interactions & Secondary Enabling Objectives	Media
		one more time to improve your score. Be prepared that the questions may not be the same.		
<p>In preparation for writing a comparative essay on research methodologies, use the material from the readings, as well as use library or other research resources to complete the following before or on the assignment's due date:</p> <ul style="list-style-type: none"> ● Locate material of suitably respectable academic quality that provides answers or explanations to each of the topic areas generated in the questions ● Cite your references that you will use in your essay following the APA style guide 	<p>Cognitive Strategies (Discovery and Guided discovery) and Problem Solving (Problem space):</p> <ul style="list-style-type: none"> ● Use library and other similar resources to support writing an essay to answer the unit questions 	<p>6. Prepare to write an essay 8 – 15 pages in length that compares and contrasts formative research methods with at least two other research methods, and that also presents issues associated with employing formative research methods.</p> <p>Visit the campus library and request research assistance, if you like, to find answers to the following questions:</p> <ul style="list-style-type: none"> ● What are some examples of different research methodologies? ● What are their distinguishing characteristics? ● What is Formative Research Methodology? ● What are different forms of Formative Research and when are they best used? ● What are some examples of research conducted using Formative Research Methodology? 	<p>Learner-other:</p> <ul style="list-style-type: none"> ● Use the campus librarian for help with locating appropriate materials <p>Learner-content:</p> <ul style="list-style-type: none"> ● Use the campus library resources or other resources available through the Internet to locate appropriate materials to provide substantial answers to all questions in a narrative format ● Record all resources used to answer the questions and save the references in APA style 	<ul style="list-style-type: none"> ● Campus librarian ● Campus library ● Campus library online resources ● Internet ● Personal Computer ● Web browsing software ● Word processing software

Primary Instructional Objectives	Instructional Events	Descriptions	Interactions & Secondary Enabling Objectives	Media
		<ul style="list-style-type: none"> What are the advantages / disadvantages of using Formative Research methods? What issues are associated with Formative Research Methodologies? 		
<p>Using the material from the readings and by using library or other research resources complete the following before or on the assignment's due date:</p> <ul style="list-style-type: none"> Compare and contrast through an essay Reigeluth and Frick's Formative Research focus and methodology with empirical research methodologies, such as Quantitative or Qualitative approaches Through the same essay, identify and elaborate on issues 	<p>Cognitive Strategies (Discovery and Guided discovery) and Problem Solving (Problem space):</p> <ul style="list-style-type: none"> Write an essay and deliver by the due date 	<p>7. Write an essay 8 – 15 pages in length that compares and contrasts formative research methods with at least two other research methods, and that also presents issues associated with employing formative research methods.</p> <p>Essay Directions:</p> <ol style="list-style-type: none"> Review assessment rubric prepared for this assignment. Review the due dates for posting preliminary drafts and your final copy of this assignment. Scan the supplemental reading materials and select at least two research methods you want to use to compare against formative research methods. Keeping in mind the due dates, read and review your selected research methods. Extend your knowledge by 	<p>Learner-content:</p> <ul style="list-style-type: none"> Write an essay, appropriately formatted, to provide detailed answers in a narrative format to all questions Check the essay for correct APA style Check spelling, grammar, and punctuation Turn in on or before the set due date 	<ul style="list-style-type: none"> Campus librarian Campus library Campus library online resources Internet Personal Computer Web browsing software Word processing software Web page / Webcourses @UCF

Primary Instructional Objectives	Instructional Events	Descriptions	Interactions & Secondary Enabling Objectives	Media
<p>associated with Formative Research methodologies by using references that clearly demonstrate research and study of the methodology beyond information found in the course textbook</p>		<p>searching for and reading additional print and online information on research methods (some are provided in the supplemental reading area as web URLs) while keeping a focus on literature that describe issues on using formative research methods.</p> <p>6. Outline your paper. If you want to, post your outline before the "post" date and ask me to review it and provide feedback.</p> <p>7. Prepare and post drafts of your comparison paper before or on "post" date and review other people's drafts.</p> <p>8. The essay should have an introduction, several sub-sections that treat each of the question topics, a sub-section that presents personal reflections and concerns on using Formative Research Methodologies and for what project you might employ the methodology, and a closing summary or conclusion.</p> <p>9. The essay should have a references section that follows the APA style guide.</p> <p>10. The essay should be clearly written, make logical sense, and be free of spelling, grammar, and</p>		

Primary Instructional Objectives	Instructional Events	Descriptions	Interactions & Secondary Enabling Objectives	Media
		<p>punctuation errors.</p> <p>11. The essay is submitted to the instructor in electronic form (MS Word or PDF), or in paper format (only with permission of the instructor) before or on the assignment due date.</p> <p>12. If you have any questions or concerns regarding this assignment, contact the instructor as soon as possible. Use the contact information located on the instructor’s course syllabus page.</p>		
<p>Students will distinguish formative research methodology from other research methodologies and explain the methodologies, applications, and issues associated with formative research</p>	<p>Cognitive Strategies (Direct instruction):</p> <ul style="list-style-type: none"> ● Review the graded essay and instructor comments 	<p>8. Receive the graded essay back from the instructor and review instructor comments.</p> <ul style="list-style-type: none"> ● Reflect on instructor comments ● Ask yourself, “Is there room for improvement on how you might improve your work?” If your answer is “Yes” then make the necessary corrections to your essay and submit it back to the instructor with a paragraph or two on your reflections of what you changed, why, and how you might use what you’ve learned in the future. Your instructor 	<p>Learner-content:</p> <ul style="list-style-type: none"> ● Review the graded essay ● Consider corrections ● Make corrections (individual choice) ● Write 1-2 paragraphs regarding the changes you made <p>Learner-instructor:</p> <ul style="list-style-type: none"> ● Submit your corrected essay with your reflective paragraph to your instructor 	<ul style="list-style-type: none"> ● Internet ● Personal Computer ● Web browsing software ● Word processing software ● Web page / Webcourses @UCF

Primary Instructional Objectives	Instructional Events	Descriptions	Interactions & Secondary Enabling Objectives	Media
		<p>may give you additional points for this corrective work.</p> <ul style="list-style-type: none"> ● If you believe your work is already of high quality and does not need correction, then your assignment is complete for this unit of instruction. 		

Rationale for Media Selection

Most of the media forms for this assignment involve personal computer and interactions with pages navigated to by the Internet. The remaining interactions may involve learner-other, as the student may elect to seek assistance from a university librarian. The rationale for selecting web pages/Internet/Webcourses@UCF as the primary media form is the assumption that this unit will be included as part of course that follows either a M (Mixed Mode) or W (Web Only Mode) type class at the University of Central Florida. For M or W type courses, some or all of the interactions are designed to be delivered through an online course management system, such as Webcourses@UCF (i.e., UCF’s branding of the Blackboard System), which reflects the specific choices made with this course treatment plan.

Evaluation Chart – Derived Following the Elaboration Theory Strategy

Outlined below in Table 3.3., we have the Evaluation Chart that provides details regarding assessment strategies in sufficient detail to guide instructional developers with their efforts to develop the assessment materials. The Evaluation Chart table includes elements that directly link it to the preceding table (Table 3.2 - the Instructional Strategies table), which will

facilitate developers or course instructors with the work of maintaining the course (i.e., the tables are cross-referenced through the objectives column) as the course might require adjustment in future university terms.

Table 3.3. Evaluation Chart – Derived Following the Elaboration Theory

Knowledge/Skill	Objective	Assessment
<p>Planning:</p> <ul style="list-style-type: none"> ● Prepare, review, and seek clarification 	<p>Enabling Objective 3.1:</p> <p>Having received the instructional unit on Formative Research Methodologies:</p> <ul style="list-style-type: none"> ● Prepare to take the educational unit on Formative Research Methodologies (1) by reviewing the assignment instructions and due dates for deliverables, and (2) by contacting the instructor for any necessary clarifications within one day of receiving the assignment 	<p>Student self-check:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Navigate to the unit assignment pages <input type="checkbox"/> Review the instructions and expectations <input type="checkbox"/> Contact the instructor for clarification if necessary
<p>Concepts –</p> <p>Remember,</p> <p>Understand:</p> <ul style="list-style-type: none"> ● Identify differences... ● Identify different kinds of formative research... 	<p>Enabling Objectives 3.2, 3.3:</p> <p>Having completed the text book and supplemental reading assignments:</p> <ul style="list-style-type: none"> ● Identify the differences between traditional empirical research methodologies and formative research methodology ● Identify different kinds of formative research studies and their respective methodologies <p>After successfully taking the quiz, reviewing the score, and revisiting the readings to correct any mistakes (if needed), retake the quiz a second time to improve the score.</p>	<p>Multiple Choice Quiz for Unit 1</p> <p>Quiz Design Instructions:</p> <ul style="list-style-type: none"> ● Quiz contains True/False and Multiple Choice type questions ● Quiz is to be opened (i.e., made available for student access) one week prior to the quiz deadline, after which, the quiz is to be closed (access is refused) ● Each quiz item carries a value of 2 points ● Students can take the quiz two times, and there is a time limitation for each try: one hour ● Quiz is to be made available for immediate grading and will be viewable by the student ● The largest score will be the final score

Knowledge/Skill	Objective	Assessment
		<p>Quiz Sample Questions:</p> <p>Which method below is not a research methodology?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Case study <input type="checkbox"/> Correlation <input type="checkbox"/> Naturalistic observation <input type="checkbox"/> Survey <input type="checkbox"/> Experimental <input type="checkbox"/> None of those stated <input type="checkbox"/> All of those stated <p>5-10 Questions about different research methodologies will be submitted as quiz elements. [For the remaining questions, please see the first section in the document <i>Multiple Choice Quiz for Unit 1.doc.</i>]</p> <p>An underlying logic of formative research is that any weakness that is found in an application may reflect weaknesses in the theory, and any improvements identified for the application may reflect ways to improve the theory.</p> <ul style="list-style-type: none"> <input type="checkbox"/> True <input type="checkbox"/> False <p>5-10 questions about formative research [see</p>

Knowledge/Skill	Objective	Assessment
		Reigeluth and Frick, pp. 633-651] [For the remaining questions, please see the second section in the document <i>Multiple Choice Quiz for Unit 1.doc.</i>]
Problem Solving / Research: <ul style="list-style-type: none"> ● Locate material ... ● Cite your references... 	Enabling Objectives 3.4, 3.5: In preparation for writing a comparative essay on research methodologies, use the material from the readings, as well as use library or other research resources to complete the following before or on the assignment's due date: <ul style="list-style-type: none"> ● Locate material of suitably respectable academic quality that provides answers or explanations to each of the topic areas generated in the questions ● Cite your references that you will use in your essay following the APA style guide 	Student self-check: <ul style="list-style-type: none"> <input type="checkbox"/> Walk to the library or navigate to the library's online research interface <input type="checkbox"/> Contact the librarian for research assistance if necessary <input type="checkbox"/> Locate suitable material to support fulfilling the essay writing assignment.
Cognitive Strategies: <ul style="list-style-type: none"> ● Compare and contrast... ● Identify and elaborate on issues associated with Formative Research methodologies... 	Enabling Objectives 3.6, 3.7: Using the material from the readings and by using library or other research resources complete the following before or on the assignment's due date: <ul style="list-style-type: none"> ● Compare and contrast through an essay Reigeluth and Frick's Formative Research focus and methodology with empirical research methodologies, such as Quantitative or Qualitative approaches ● Through the same essay, identify and elaborate on issues associated with Formative Research methodologies by using references that clearly demonstrate research and study of the methodology beyond information found 	Rubric for final paper: Unit 1 – Foundations of Formative Research Methodology Distinguished (90-100pts) Contents: <ul style="list-style-type: none"> ● Presents clear and concise explanation of each selected research method. ● Includes, but not limited to, explanation of: epistemological and theoretical foundations; purposes, processes, products and outcomes; and benefits and limitations of each research method. ● Compares and contrasts major points associated with

Knowledge/Skill	Objective	Assessment
	<p>in the course textbook</p>	<p>each method, noting key differences and similarities.</p> <ul style="list-style-type: none"> ● Clearly identifies and describes issues associated with the use of formative research methods. ● All major points are covered and described in specifics. ● Depth and complexity of ideas supported by rich, engaging and pertinent details. ● References 3 or more resources that support your descriptions or arguments. <p>Clarity:</p> <ul style="list-style-type: none"> ● Writing is exceptionally clear, well organized and flows smoothly from paragraph to paragraph (e.g., good transitions). ● Establishes and maintains clear focus and purpose. ● Style is easy to follow with a clear beginning, middle and end. ● Each paragraph contains topic sentence and all successive statements are directly related to topic. <p>Grammar And Presentation:</p> <ul style="list-style-type: none"> ● No grammar or punctuation errors. ● Formatted and presented in professional fashion ● Adheres to APA style guide.
<p>Concepts, Cognitive</p> <p>Strategies:</p> <ul style="list-style-type: none"> ● Students will distinguish formative research methodology from 	<p>Terminal Objective 3.0:</p> <p>Students will distinguish formative research methodology from other research methodologies and explain the methodologies, applications, and issues associated with formative research</p>	<p>Student self-check:</p> <ul style="list-style-type: none"> <input type="checkbox"/> The essay was submitted correctly to the instructor <input type="checkbox"/> The essay was submitted on time <input type="checkbox"/> The student reflects whether the assignment

Knowledge/Skill	Objective	Assessment
other research methodologies and explain...		objective was fulfilled

Reflection on the Elaboration Theory

The Elaboration Theory presented some challenges that are, or can be, both minor and significant. Additionally, the theory as it is presented in the book required further structuring to improve the design process. Lastly, once the pieces of how to apply the theory were in place, the design process went smoothly and quickly resulting in a pleasurable designing experience that we hope will yield a good and useful instructional outcome.

The challenges experienced by applying the theory to the design process were the following: (1) the theory presents a high level process that needs to be brought down and into context to be useful; and (2) the theory advocates an overall approach to begin broad and proceed to increasing levels of detail. For the first, the presentation of the theory in Reigeluth's chapter includes a great deal of description, but there is little context (i.e., the theory applied to an actual project). This was at first a minor problem that required more thought as to how to bring together the treatment plan elements with the Elaboration Theory. How this was achieved is discussed in the next paragraph. For the second, a significant problem can arise stemming from the premise that the Elaboration Theory design begins with a broad treatment of the targeted domain and leads to higher levels of detail. This will become problematic when there is insufficient data on the initial prerequisites for the first lesson unit to be designed: if the initial conditions that describe pre-existing knowledge and skill are ambiguous or not well defined, the designer will potentially feel obligated to begin too broadly, thus creating a larger, more complex instructional

project than might have been anticipated. This is a warning for all Elaboration Theory practitioners: be sure to have detailed data on the prerequisite knowledge base that provides the entry point for your instructional design; otherwise, you can expect scope creep or an overly large project as a result.

As identified above and alluded to in the previous paragraph, to fully explore the Elaboration Theory in actual practice, some structuring had to take place. What we did was to first create a table (see table 3.1, Design Plan with Reigeluth's Elaboration Theory) that in the left column contained all the process steps of the theory, and then in columns to the right, the designer can place pertinent design notes for the particular instructional topic. Once this was done, the design effort went fairly smoothly, although it required several iterations until the full structure of that design plan table became complete.

With the design plan table complete, the development of the other treatment plan elements (i.e., the instructional strategy, table 3.2, and the evaluation chart, table 3.3) could be readily developed. As mentioned, some iteration to the design process will take place as the designer must continually check to see that the plan table appropriately guides the inclusion of the specific strategy and assessment items. The overall experience with this theory is that it warrants additional application testing in other instructional design circumstances, but that this particular application was enjoyable and fairly straight forward.

Comparative Analysis: Three Approaches to Developing a Treatment Plan

In table 4.1 below, we compare the results of using the different theories to build an instructional solution for the same targeted outcome. This team found that an approach to this

analysis might be accomplished by asking questions regarding the result of our design experience: these questions are in the column titled, *Design Considerations*.

Table 4.1 Comparative Analysis of Treatment Plans

Design Considerations	Mayer – SOI Model	Schwartz et al – Flexibly Adaptive Instructional Design	Reigeluth – Elaboration Theory
The primary theory focus is to...	Foster knowledge construction through directed instruction (expository-based).	Provide a flexibly adaptive instructional strategy that does not compromise grounded instructional theory findings.	Provide an instructional design strategy for complex content domains. Ensure appropriate sequencing of content within lessons and between lessons.
The clarity of where, when, and how to apply this theory is...	Text-book, lecture & multi-media learning environments. Implementation of specific contextual techniques to draw attention to different aspects of content.	The inherent focus on flexibility and adaptability suggest a diverse range of applicable scenarios where this theory may be used successfully.	Reigeluth specifies that this theory should be applied for content areas that require task or domain expertise and can include complex procedures.
The utility of theory application instructions is...	Helpful for implementing techniques into text,	This theory is very easy to apply. The prescriptive nature is easy to follow and	The instructions were helpful for when to use the theory, as well as to

Design Considerations	Mayer – SOI Model	Schwartz et al – Flexibly Adaptive Instructional Design	Reigeluth – Elaboration Theory
	<p>otherwise did not provide additional guidance for the instructional sequencing.</p>	<p>the instructional events are provided in the context of an example. The greatest challenge in application is making the instruction relevant to the learner. This theory essentially requires the designer to think about relevance.</p>	<p>provide some guidance in the structure and sequence of instructional content.</p>
<p>The generalizability of this theory is...</p>	<p>Can be implemented for multiple subject-areas however is limited to text-based learning.</p>	<p>As previously stated, this theory was designed to be flexibly adapted to numerous contexts. One limitation of generalizability is the assumption of a classroom. Self-directed learning may require modifications for key events.</p>	<p>It seems very possible that this theory could be readily generalized for other content domains.</p>
<p>The readiness of this application to be applied from the Reigeluth book is...</p>	<p>The theory was easily implemented from its current state in the instructional-design</p>	<p>The theory was very easy to apply as it was structured as a very flexible sequence of events.</p>	<p>The theory as presented required the building of a separate table to aid the process of working the</p>

Design Considerations	Mayer – SOI Model	Schwartz et al – Flexibly Adaptive Instructional Design	Reigeluth – Elaboration Theory
	theory book.		targeted instructional material. Potentially, similar efforts may be required for different applications of the theory across domains.
This theory would be best applied for projects that are...	Text-Based instruction such as text-books, lectures, multi-media and web-based learning environments.	Instructional goals that value cooperation and collaboration will probably be the best applications of this theory.	Complex in terms of the variability and conditions of the area of expertise involved: procedures or processes that vary highly. For such situations, there is no simple way to teach mastery. Similarly when conditions vary for the tasks or knowledge domains, applying this theory to guide instructional design is appropriate.
Application strengths of this	As education continues to use expository	This theory is very prescriptive providing	It is highly effective for aiding in the design of

Design Considerations	Mayer – SOI Model	Schwartz et al – Flexibly Adaptive Instructional Design	Reigeluth – Elaboration Theory
theory are...	resources for learning, this theory provides guidance on how to incorporate constructivist techniques into such learning environments.	specific instructional events that are easy to follow and implement. However, each instructional event is very easy to adapt to the specific instructional goal. Furthermore, the progressive deepening cycles allow the sequence to be adapted in a manner consistent with Reigeluth's elaboration theory.	complex tasks or knowledge domains. It is also highly effective for strategizing the sequencing of the content within the lesson, as well as between lessons.
Application weaknesses or constraints of this theory are...	The theory does not provide specific methods on how to best incorporate other key sections of a unit: introduction, conclusions, and assessments.	The authors of the theory have specific ideas of assessment that may not match designers' expectations who wish to use the theory. It therefore may be a challenge to implement assessments.	A model needed to be developed to facilitate and guide the building and sequencing of the lessons. For the guidelines in the book, while they are rich with details, they are overly generalized and lacking in contextual application of the theory.

Design Considerations	Mayer – SOI Model	Schwartz et al – Flexibly Adaptive Instructional Design	Reigeluth – Elaboration Theory
Other considerations we have are...	An experienced designer would be best apt to implement this theory as its weaknesses may burden a novice designer. The expert should easily be able to fill in the gaps and pull from this theory’s strengths.	If you use this theory, be ready to rethink your material in ways that motivate learners.	Be sure to know your instructional design entry points (i.e., prerequisite knowledge, etc) as this can lead to significant project scope creep stemming from beginning the lesson at an overly broad level.
Some similarities to the resulting instructional strategies section are...	All of the instructional strategies include the following elements in the design: planning, challenging (or problem solving), organizing, and elaborating (or revising).		
Some differences to the resulting instructional strategies section are...	Focus is on cues (outlines, headings, signal words, graphic elements, advance organizers, etc) to highlight instructional material differences	Focus is on different steps that invoke interaction between learner and the instructional content, similar to creating a dialog between two or more people	Focus is on the complexity differences between each sequence element
Some similarities to	All of the evaluation charts produce a focus on similar, high level cognitive skills as		

Design Considerations	Mayer – SOI Model	Schwartz et al – Flexibly Adaptive Instructional Design	Reigeluth – Elaboration Theory
the resulting evaluation charts section are...	evidenced by key words: identifying, comparing and contrasting, and distinguishing.		
Some differences to the resulting evaluation charts section are...	Focus yields a final outcome that produces a Formative Research Plan	Focus yields a final outcome that produces a Formative Research Plan	Focus yields a final outcome that compares and contrasts different research methods and identifies issues associated with conducting Formative Research
Our overall recommendation regarding the application of this theory is...	This was a useful and effective theory for instructional design. Its cognitive processing approach to text-based learning can be easily adapted to any content and would lend itself nicely to a web-based project.	This theory is an excellent theory that should be considered by designer's developing instruction for environments with groups of learners. It is very prescriptive in nature, but not to the point it is rigid. It will focus the designer to think about their material in a manner that is relevant to the learner, which can only	This is a very useful and efficient instructional design theory. Once all the above noted issues are addressed, this theory should be applied for other instructional situations with the same degree of effectiveness monitoring to determine other potential application issues.

Design Considerations	Mayer – SOI Model	Schwartz et al – Flexibly Adaptive Instructional Design	Reigeluth – Elaboration Theory
		result in more effective instruction. The flexibility enabled by the theory allows other instructional theory's to be accommodated.	

In conclusion, the team found each theory to have strengths, as well as limitations. Mayer’s SOI Model was perceived as being able to fit well with the continued use of expository resources of educational environments while Schwartz et. al’s Adaptive Design strength was in its ease of use and its ability to change to the instructional-design goal. Reigeluth’s Elaboration Theory was highly effective in aiding the design of complex tasks as well as strategizing the sequencing of content. Despite each theory having individual strengths and foci, all were perceived as having generalizable structures which lended themselves nicely to the development of our treatment plans. The Adaptive Design tended to have the most flexibility in terms of easily adapting to any design while the SOI model and Elaboration theory had specific application setting requirements.

Although all three were found useful and effective for our team’s formative research design project, limitations were uncovered within every one. The SOI model’s narrow focus on text manipulation was felt not to provide adequate detail on other aspects of the design process. The Adaptive theory’s perception on assessment, being open-ended in nature, will challenge how to incorporate the theory alongside current traditional assessment practices. The Elaboration

theory's in-depth coverage left it over-generalized and lacking of contextual application to the theory. In the end, we strongly feel that the Adaptive theory by Schwartz et. al best addresses the needs of our project based on it's prescribed yet adaptive ability to design.

Overall Reflections

Immediately following each evaluation chart, the team provided commentary regarding the particular experiences associated with the application of the particular design theory. Rather than repeat that information, this final section will summarize those reflections.

Mayer's SOI model works well to incorporate strategies for expository learning resources, but it does not provided guidance on the organization for an introduction, conclusion and assessment portions of a module/lesson. Due to this limitation, we feel that more experienced designers could easily use this theory since they could fall back on their extensive design experience. We do not recommend a novice designer to use this theory in a solo expedition. Finally, the model does work well in situations that involve computer-based learning environments.

Schwartz et al.'s Flexibly Adaptive Design Theory is more of an instructional strategy than the other two theories. Mayer and Reigeluth both focus on content, with Mayer focusing on how to present the content and Reigeluth focusing on how to sequence it. Both of these theories can be easily accommodated in the Schwartz et al. theory. Mayer's prescriptions can be used in the content presentation instructional events such as the Multiple Perspectives event. Reigeluth's prescriptions can be used to sequence the progressive deepening inquiry cycles in an elaborative manner. Thus, it seems that each theory varies in its ability to be used *as* an instructional strategy. In this regard, the Schwartz theory seems to have the highest degree.

Reigeluth's Elaboration Theory is strong for situations requiring the development of instruction for complex tasks or domains. The theory provides a framework for instructional designers to approach a body of material and to approach the work of sequencing the instructional content, both within a lesson (or unit) and between lessons. The theory seems fairly straight forward to apply, but we discovered that it is not intuitive from following the guidelines presented in Reigeluth's article (Reigeluth, 1999, pp. 425-453) – the article is missing a contextual example. Therefore, we found it necessary to create an interim table to plan the big picture of the instructional plan for the lesson, and then use that to guide the development of strategies and assessment plans for the particular lesson. In addition, we found that designers need to be aware that they must be sure of their targeted learner's prerequisite knowledge and skills, as failure to adequately identify these will likely lead to an entry point in the design that is too broad, which can lead to project scope creep or increasing the size of the design project.

Appendix 1

Assessment 1.1: Formative Research Plan Rubric for SOI Model

Unit 1: Foundations of Formative Research Quiz	
Directions	
	Choose the correct answer for each of the following questions:
Questions	
1.	Intention to improve theoretic design, instructional resources and curricula are characteristics of formative research.
	True

False

2. Which of the following are types of formative research?
 - a. Designed Case
 - b. In Vivo/Post Facto Naturalistic Case
 - c. Both A & B**
 - d. None of the above

3. What are the three dimensions of the preferability evaluation criteria of formative research?
 - a. Appeal, Effectiveness, & Efficiency**
 - b. Appeal, Efficiency, & Validity
 - c. Effectiveness, Efficiency & Validity
 - d. Appeal, Effectiveness, & Validity

4. Which of the following is not a procedure for formative research on an existing theory?
 - a. selecting a design theory
 - b. create a case to help you generate the design theory**
 - c. revise the instance
 - d. offer tentative revisions for the theory

5. Construct validity, sound data collection and attention to generalizability are key issues of formative research.

True

False

Assessment 1.2: Formative Research Plan Rubric for SOI Model

Distinguished

- Identification of clear, concise overview with instructional purpose, audience and

(50-45pts)	<p>context.</p> <ul style="list-style-type: none"> • Identification and justification of purpose statement • Complete, clear and concise formative research plan including all specified areas (background, purpose, subjects, design, instruments, procedures, protocols, reflection, results and discussion) • Complete, clear and concise descriptions of methods used • Instruments used are well designed and address purpose of plan • Identifies and discusses methodological issues of formative research • Provides a reflection including recommendations, limitations and constraints faced during the development of research plan. • Posted correctly to presentation area • Posted on or before specified due date • Report well-formatted and presented in professional manner, controlling for surface features with little to no grammatical errors.
Proficient (44-40pts)	<ul style="list-style-type: none"> • Identification of overview with instructional purpose, audience and context. • Identification and justification of purpose statement • Completed formative research plan including specified areas (background, purpose, subjects, design, instruments, procedures, protocols, reflection, results and discussion) • Complete descriptions of methods used • Instruments used are provided and address purpose of plan • Identifies methodological issues of formative research • Provides a reflection missing specified areas. • For the most part, posted correctly to presentation area. • Posted on or before specified due date • Report is professional however has some grammatical errors.
Developing	<ul style="list-style-type: none"> • Identification of overview without instructional purpose, audience and context.

(<40pts)	<ul style="list-style-type: none"> • Identification and justification of purpose statement is not included • Incomplete formative research plan lacking specified areas • Incomplete descriptions of methods used • Instruments used were not provided or do not address purpose of plan • Methodological issues of formative research are not stated. • Reflection is not included • Report has many grammatical errors. • Posted incorrectly or not posted to presentation area • Posted after specified due date
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Appendix 2 – Elaboration Theory

Rubric for final paper: Unit 1 – Foundations of Formative Research Methodology

Target Outcomes:

Compare and contrast through an essay Reigeluth and Frick’s Formative Research focus and methodology with at least two different research methodologies, such as Quantitative or Qualitative

Through the same essay, identify and elaborate on issues associated with Formative Research methodologies by using references that clearly demonstrate research and study of the methodology beyond information found in the course textbook

Distinguished

(90-100pts)

Contents:

- Presents clear and concise explanation of each selected research method.
- Includes, but not limited to, explanation of: epistemological and theoretical foundations; purposes, processes, products and outcomes; and benefits and limitations of each research method.
- Compares and contrasts major points associated with each method, noting key differences and similarities.
- Clearly identifies and describes issues associated with the use of formative research methods.
- All major points are covered and described in specifics.

- Depth and complexity of ideas supported by rich, engaging and pertinent details.
- References 3 or more resources that support your descriptions or arguments.

Clarity:

- Writing is exceptionally clear, well organized and flows smoothly from paragraph to paragraph (e.g., good transitions).
- Establishes and maintains clear focus and purpose.
- Style is easy to follow with a clear beginning, middle and end.
- Each paragraph contains topic sentence and all successive statements are directly related to topic.

Grammar And Presentation:

- No grammar or punctuation errors.
- Formatted and presented in professional fashion
- Adheres to APA style guide.

Proficient

(80-89pts)

Contents:

- Presents explanation of the selected research methods.
- For the most part, includes explanation of: the epistemological and theoretical foundations; purposes, processes, products and outcomes; and benefits and limitations of each research method.
- Compares and contrast major points associated with each method in some detail.
- Identifies and describes issues associated with the use of formative research methods.
- Most points are covered and described in some specifics.
- Depth and complexity of ideas supported by pertinent details.
- References 2 resources that support your descriptions or arguments.

Clarity:

- Writing is clear, well organized and flows from paragraph to paragraph.
- Style is easy to follow with a beginning, middle and end.
- Establishes and maintains focus and purpose.
- Each paragraph contains topic sentence and most statements are related to topic.

Grammar And Presentation:

- Few grammar or punctuation errors.
- Presented and formatted in somewhat professional fashion.
- For the most part, adheres to APA style guide.

Unsatisfactory (<80pts)

Contents:

- Content presented in haphazard manner and is not well thought out.

- Fails to include explanation of: the epistemological and theoretical foundations; purposes, processes, products and outcomes; or benefits and limitations of each research method.
- Simply summarizes, rather than compares and contrasts major points made in each research method.
- Fails to identify and describe issues associated with the use of formative research methods.
- Research methods are explained in broad, general terms lacking pertinent details.
- Fails to reference 2 resources that support your descriptions or arguments.

Clarity:

- Writing is unclear, not well organized and does not flow from paragraph to paragraph.
- Does not maintain clear focus or purpose.
- Style is not easy to follow and does not include a beginning, middle and end.
- Each paragraph does not contain topic sentence and successive statements are not related to topic.

Grammar And Presentation:

- Serious grammar or punctuation errors that affect document readability.
- Not presented or formatted in professional fashion.
- Does not adhere to APA style guide.

Multiple Choice Quiz for Unit 1

Which method below is not a research methodology?

- Case study
- Correlation
- Naturalistic observation
- Survey
- Experimental
- None of the examples stated**
- All of the examples stated

With Naturalistic observation, behavior can be explained.

- True
- False**

With Naturalistic observation, researchers may have to wait for some time to observe the behavior or phenomenon of interest.

- True**
- False

Case studies have the following strength or strengths:

- Identifying causal influences and interaction effects which might not be treated as operationalized variables in a statistical study
- Has the capability of uncovering causal paths and mechanisms

- Helpful in generating hypotheses and theories in developing fields of inquiry
- None of the examples stated
- All of the examples stated**

With comparative case studies, both qualitative and quantitative comparisons are generally made.

- True**
- False

Case studies are representative of entire populations.

- True**
- False

Critics of the case study method believe that the study of a small number of cases can offer no grounds for establishing reliability or generality of findings.

- True**
- False

The survey describes a methodology that is non experimental and descriptive.

- True**
- False

Survey methods can offer insights into cause-and-effect relationships.

- True
- False**

In correlation type studies, variables are not directly manipulated.

- True**
- False

In experimental type studies, variables are not directly manipulated.

- True
- False**

5-10 Questions about different research methodologies [Resources for additional questions:

- [Maricopa.edu – online overview and review tool](#)
- [Case studies 1](#), [Case studies 2](#), [Case studies 3](#)
- [Center for psychology resources](#)
- [Qual Page](#)

- [Methods in Behavioral Research – Cozby, CSUF \]](#)

An underlying logic of formative research is that any weakness that is found in an application may reflect weaknesses in the theory, and any improvements identified for the application may reflect ways to improve the theory.

- True**
 False

Formative research follows a case study approach.

- True**
 False

With design case formative research methods, if the researcher instantiates the theory, the researcher must then _____ the instantiation.

- apply
 develop
 evaluate
 correlate

With post facto naturalistic cases, the formative evaluation of the instantiation is done during its application.

- True
 False

With in vivo naturalistic cases, the formative evaluation of the instantiation is done after its application.

- True
 False

The process for conducting post facto naturalistic studies is the following:

- Select a design theory, select a case, collect and analyze formative data on the case, offer tentative revisions for the theory**
 Select a design theory, collect and analyze formative data on the case, offer tentative revisions for the theory
 Select a case, collect and analyze formative data on the case, offer tentative revisions for the theory
 Select a design theory, design an instance of the theory, collect and analyze formative data on the instance, revise the instance, repeat the data collection and revision cycle, offer tentative revisions for the theory

For formative research, there are _____ threat(s) to construct validity:
 _____ .

- one; omission
 two; omission and commission
 three; omission, commission, operationalization of relevant situations

four; omission, commission, operationalization of relevant situations, review by expert in the selected theory

Enhancing the credibility of the data derived through formative research methods, a research can employ:

- Triangulation
- Chain of evidence
- Member checks
- Clarification of the researcher's assumptions, biases, and theoretical orientation
- None of the methods stated
- All of the methods stated**

Data sources used to provide triangulation can involve:

- Multiple participants
- Multiple collection iterations
- Striving for results consistency
- The first two strategies stated
- All of the strategies stated**

Situationality increases the rigor of formative research by enhancing theory generalizability. As such, a researcher can explore situationality by

- Looking for different results in different iterations
- Purposely varying the elements of the situation in data collection rounds
- Doing both**
- Doing neither: theory generalizability is demonstrated through the research process

Replication is important to enhance theory generalizability.

- True**
- False

5-10 questions about formative research [see Reigeluth and Frick, pp. 633-651]

References

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