

A DESIGN-BASED RESEARCH APPROACH TO THE IMPLEMENTATION AND
EXAMINATION OF A COGNITIVE FLEXIBILITY HYPERTEXT IN
A LARGE UNDERGRADUATE COURSE

A Dissertation
presented to
the Faculty of the Graduate School
at the University of Missouri-Columbia

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Philosophy

by
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AUGUST 2007

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A DESIGN-BASED RESEARCH APPROACH TO THE IMPLEMENTATION AND
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UNDERGRADUATE COURSE

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To my wife “Ina” Mihaela who found the energy and patience to change continents and cultures to support and encourage me throughout this second dissertation program.

ACKNOWLEDGEMENTS

This dissertation was possible due to the efforts of the faculty, staff, and graduate students from the School of Information Science and Learning Technologies (SISLT) who make the SISLT doctoral program active, innovative, and engaging. During my residency program I benefited greatly from the professional competency of many SISLT faculty members. I experienced this professionalism not only in their courses but also in the additional professional and social activities they organized or sponsored which successfully complemented the educational offerings of this program. I also had the opportunity to work with a group of smart, curious, and collegial fellow graduate students who came from various corners of the earth and brought with them a wealth of cultural and professional perspectives. Both my professors and my colleagues very often served as "cognitive mirrors," helping me to refine and improve my dissertation research.

I was fortunate to find a great advisor and mentor, Dr. David Jonassen, to whom my deepest gratitude goes. He patiently modeled and scaffolded my immersion in a new field, applied educational psychology. With my academic growth as a primary goal, he continuously challenged me by revealing opportunities rather than imposing prescriptive paths. I would also like to express special thanks to the faculty that served on my dissertation committee: to Dr. Sanda Erdelez for her continually challenging me to increase the depth of my analysis; to Dr. John Wedman for his ability to push me to define the boundaries that structured my research; to Dr. Jim Laffey for the scrutiny of my research methods and results which helped me to avoid traps typical for doctoral research; and finally to Dr. Steve Friesen for his willingness to meaningfully integrate technology in his classroom and to make me part of this process.

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CHAPTER 1

INTRODUCTION

I was teaching introduction to the Old Testament; and there was a student in the class, a very conservative Christian student, and she was having a tough time encountering questions about history...and interpretation; even her body language expressed it; I can see her arms crossed ...and she would not say much. In one of the workbook assignments that she handed in, she worked through the questions and did a good job answering them and at the end [she] put a note saying..." but I don't believe these ... "

I responded to her and I said: "That's great. You don't have to believe it. You have to understand it, to be able to understand another point of view." And ... just like a light bulb went on for her... she opened up, she start talking in class, she ended up taking another class, bible class... . (Interview with the course instructor)

Most seasoned instructors have at least one success story such as the above that shows both the nature of the challenges they have faced in their teaching and the solutions they have found in that specific challenge's context. Dealing with classroom diversity while trying to engage students in meaningful and rewarding instructional activities has proven to be a real challenge for both researchers and practitioners in the field of education. One set of answers to such classroom learning challenges was offered by proponents of constructivist epistemologies starting with the late 1980's.

1.1 Design-Based Research: Implementing Innovations in Classroom Setting

Situated learning (e.g. J. S. Brown, Collins, & Duguid, 1989), anchored instruction (e.g. Cognition and Technology Group, 1992), or cognitive flexibility theory (e.g. Spiro, Feltovich, Jacobson, & Coulson, 1995; Spiro & Jehng, 1990; Spiro, Vispoel, & Schmitz, 1987) are some of the theoretical frameworks and/or models that have set landmarks for research efforts that deal with the complexity of classroom learning.

Through these theoretical frameworks, technology has become the main agent to: a) moderate the implementation of these frameworks in classroom settings; and b) engage learners in complex and authentic learning activities based on real-world challenges (Duffy & Jonassen, 1992).

In their attempt to implement theoretically-designed learning environments in real-world classroom settings, educational researchers were faced with the challenge of finding a framework of scientific inquiry that would allow them to integrate design and research as a more seamless activity (e.g. A. L. Brown, 1992; Cobb, 2001). Design-Based Research (DBR) emerged from these efforts as a new paradigm for educational inquiry. As an overarching framework of inquiry, DBR integrates three major factors: a) the design of innovative learning environments; b) classroom practice; and c) development of local theories of learning (e.g. Design-Based Research Collective, 2003).

At the time of my engagement in a DBR process during fall semester of 2003, DBR was still in its infancy, but it has now reached a critical mass of research results, driven by a method-centered approach which has generated several targeted efforts to: a) define the structure of the DBR process (e.g. Bannan-Ritland, 2003; Cobb, 2001; Design-Based Research Collective, 2003); b) clarify the expected outcomes of the DBR process (e.g. Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Design-Based Research Collective, 2003); and c) analyze the methodological aspects of the DBR process (e.g. A. L. Brown, 1992; Design-Based Research Collective, 2003).

1.2 Application Domain: Biblical Criticism

This study builds on the opportunity to develop and implement an online learning environment for the field of biblical criticism.

The opportunity to engage in this study emerged at the University of Missouri during the Spring Semester of 2002. At that time, a group of faculty and graduate students from the Learning Sciences Institute engaged in a long-term relationship with the instructor of the Introduction to the New Testament course. One major focus of this course was to scaffold students' ability to apply various biblical criticism methods to the analysis of Gospel texts.

Biblical criticism is comprised of a relatively large number of methodologies targeted towards study of the Scripture through application of "neutral, i.e., scientific and nonsectarian, canons of judgment in its investigation of the biblical texts" (Soulen & Soulen, 2001, p. 18). Biblical criticism as field is hosting today, along with the more traditional historical interpretation, a wealth of distinguishable, yet interrelated, criticism methods (e.g. Miller, 1993). These methods have been adopted from fields such as literary criticism, social involvement, or postmodern criticism (e.g. Soulen & Soulen, 2001). Methods such as redaction criticism, feminist interpretation, and postmodern biblical interpretation offer new perspectives on the meanings derived from the texts of the Scripture. The complexity these methods add to the debate in the field often creates frustrating experiences among scholars engaged in the teaching of biblical criticism (Haynes & McKenzie, 1993). In time these frustrations have fueled the need to find ways to address the gap between biblical criticism as an academic field and the integration of biblical criticism into undergraduate classrooms (McKenzie & Haynes, 1999, p. 6).

In an attempt to address this gap, the design team proposed to use the Cognitive Flexibility Theory (CFT) as the theoretical approach most closely aligned with the learning of biblical criticism methodologies (e.g. Spiro, Coulson, Feltovich, & Anderson, 1988; Spiro, Feltovich, Jacobson, & Coulson, 1991; Spiro et al., 1995). Cognitive Flexibility Hypertexts as instructional tools, as proposed by Cognitive Flexibility Theory, are appropriate scaffolds for the alternative interpretations proposed by the methods of biblical criticism (e.g. Spiro & Jehng, 1990).

1.3 Purpose of the Study

The overall purpose of this study is to investigate the interaction between the learning process, the design of a Cognitive Flexibility Hypertext (CFH), and the Design-Based Research (DBR) process in the context of a large undergraduate course. More specifically: a) What impact does the integration of a CFH into classroom activities have on students' learning?; b) What impact does the implementation of a DBR process have on the design of a CFH?; and b) How does the evolution of a designed CFH and its implementation in specific classroom settings inform the DBR process?

In the context of the learning process there are three main research areas which this study tries to integrate: 1) the use of biblical criticism methods as contextual meaning-making tools in Religion Studies; 2) the ability of hypertexts to scaffold the use of biblical criticism methods for the specific context proposed by Gospel texts; 3) the differences in students' performance and conceptual understanding due to individual diversity measures such as entry-level skills, levels of epistemic beliefs, or major.

In the context of the design process, this study focused on the evolution of the main design strategies that were used to integrate: 1) the theoretical grounds of Cognitive Flexibility Theory; 2) expected learning outcomes; and 3) the impact of organizational constraints on the structure of hypertext systems as main design artifacts.

In the context of the DBR process, this study focused on analysis of the research process' quality through factors such as congruence of research methods involved in the process and systemic validity. The grounds for the analysis of these quality factors are comprised of the researcher's experience gained from implementation of two DBR macro-cycles on the one hand and of the research findings from the DBR process on the other.

1.4 Structure of the Dissertation

Because the three processes that are the foci of this study (the learning process, the design process, and the DBR process) are part of a developmental timeline, the structure of this text follows this timeline for reporting purposes.

1.4.1 Structure of Chapter 2

Chapter 2 introduces the major emerging methodological aspects of the DBR process as discussed in the DBR research literature. Three main trends were found which supported the potential for development of a DBR process:

a) An existing cohesive DBR community that positioned DBR as a viable framework for understanding how theoretical claims about contextual learning can become effective learning strategies (Design-Based Research Collective, 2003);

b) An open structure of the DBR process that emphasizes both the systemic relationship between design, context, and outcome (e.g. Cobb, 2001) and the nature of the outcomes expected from this process (e.g. Cobb et al., 2003; Design-Based Research Collective, 2003); and

c) An emerging gap in addressing the methodological aspect of the DBR process due to the nature and volume of the research information on the one hand, and the ability to address reliability and validity issues on the other (e.g. A. L. Brown, 1992; Design-Based Research Collective, 2003).

1.4.2 Structure of Chapter 3

Chapter 3 describes the theory-driven design of a cognitive flexibility hypertext, Camp Hermeneutica, starting with the analysis of what Cobb calls theoretical conjectures. The main factors that lead to the theoretical conjectures associated with Camp Hermeneutica were: a) the analysis of the contextual field, in this case biblical criticism and its role in the Introduction to the New Testament course; and b) the analysis of a theoretical model to support the learning of biblical criticism, cognitive flexibility theory.

The second part of Chapter 3 presents the process of embedding the identified theoretical conjectures into a design conjecture, also called a learning trajectory (Cobb, 2001). The notion of learning trajectories proposes a set of learning tasks to scaffold the given biblical criticism methods, as well as design methods to include these tasks in simulated activities similar to those in which biblical scholars engage. The initial design conjecture that was developed for a series of activities situated in a multi-layered metaphor of a summer camp, “Camp Hermeneutica.”

It was implemented for the purpose of formative evaluation prior to the enactment of the first DBR macro-cycle. Based on the design-related conclusions of this formative evaluation, the instructor decided to use a new metaphor in which to situate the learning tasks: a temporary job as movie reviewer. The new metaphor drove the change of the online learning environment's name to "Cinema Hermeneutica". A second layer of metaphors in Cinema Hermeneutica introduced four method-driven specialized magazines: a) "Tales Told," a literary magazine specializing in narrative criticism; b) "One More Time," a recycling magazine specializing in redaction criticism; c) "Wo/men," a magazine specializing in feminist interpretation; and d) "Just the Facts," a history magazine specializing in historical criticism. Each student had to choose one of these four methods and complete the instructional tasks associated with its learning activities. Cinema Hermeneutica served as the learning trajectory for the first DBR macro-cycle.

1.4.3 Structure of Chapter 4

Following the structure of a DBR macro-cycle, Chapter 4 presents the empirical refinement stage of the first macro-cycle. To empirically refine the proposed learning trajectory, a research trajectory that monitors its implementation in actual classroom settings needs to be implemented. The research trajectory for Cinema Hermeneutica included: a) an analysis of empirical research on cognitive flexibility hypertexts that indicated both the nature of the factors that had an impact on learning and the research gap that the DBR process can address; b) the research questions associated with the implementation of Cinema Hermeneutica; c) the major constraints to the research process

for this macro-cycle; and d) the research methodologies implemented to answer the research questions.

A one one-way ANOVA with one repeated-measures factor and a series of four mixed-design ANOVAs with one repeated-measures factor, time, and between-groups factors were used for this study. Due to both the exploratory nature of this cycle and the existent research constraints, a single-group treatment was used. From the single-group treatment, the participants were assigned to subgroups included in the analysis as between-groups factors of the mixed-design ANOVAs. These subgroups resulted from significant descriptors of the diversity of the student body engaged in this course and included: a) entry-level knowledge; b) major; c) biblical criticism method; and d) epistemic beliefs level.

The overall analysis showed a *significant increase* in mean essay scores for the first instructional segment, from pretest to posttest, when Cinema Hermeneutica was part of the instructional process. Conversely, the second instructional segment that included only lectures and small-group discussions *failed* to show a significant increase of mean essay scores from posttest to delayed-posttest. As for the impact of diversity measures, two major findings proved significant for the design process of the next DBR macro-cycle. First, from the perspective of students' text interpretation skills, the structure of the activity for historical criticism *method* was less effective than the other three methods. Second, the medium *entry-level skills* group was the only one for which the mean scores increased significantly when Cinema Hermeneutica was part of the instructional process. These two major finding suggested the potential for future designs to better address the needs of both the high and low-entry level skills students in this course.

1.4.4 Structure of Chapter 5

Chapter 5 describes the revised learning and research trajectories. The two major stages approached in this chapter are: a) the data-driven redesign of the learning trajectory; and b) the design of the research trajectory for the second DBR macro-cycle.

In order to build *the new learning trajectory* using empirical evidence from the first macro-cycle, the instructor involved eight graduate students in the redesign stage during the fall semester of 2004. For the entire semester, the researcher joined the class and assumed both the roles of observer and the co-moderator together with the course instructor during the last half hour of the each week's class meeting.

After several design iterations, a newspaper metaphor was selected which, in turn, drove the name of the new online environment, "The Daily Intelligencer." This approach addressed the inconsistency of the metaphors in the previous designs, those designs' major flaw, by offering a single metaphor for the overall environment in the form of four journalism jobs at a virtual major newspaper. These jobs included: a) Editorials & Opinion (Op-Ed) for feminist interpretation; b) Investigative Reporting for historical criticism; c) a Movie section for narrative interpretation; and d) a Music section for redaction criticism. Another advantage presented by this design metaphor was that it allowed users to migrate from one job to another one vertically within a department, from one level to the next one, and horizontally across departments. This vertical career pattern allowed the designer to introduce increasing levels of complexity and address in this way the needs of a highly diverse student body. Students with low entry-level skills could find low to high-difficulty tasks, while students with high entry-level skills students could find more challenging tasks.

As for *the new research trajectory*, the focus was on students' conceptual understanding of biblical criticism to complement and expand the findings from the first DBR macro-cycle. Based on the analysis of the theoretical and empirical grounds of conceptual understanding (e.g. Bartlett, 1932; Clariana & Poindexter, 2004; Johnson-Laird, 1983; Jonassen, Beissner, & Yacci, 1993; Thagard, 1990), a case study was implemented for this second DBR macro-cycle, based on a mixed methods research approach with a concurrent inquiry strategy. Techniques from analysis of variance and from case study were used in parallel. The integration of qualitative and quantitative data allowed for triangulation of different perspectives on students' conceptual understanding and for expansion on the insights gained from a single mode of inquiry (Creswell, 2003; Morse & Richards, 2002; Tashakkori & Teddlie, 2003).

1.4.5 Structure of Chapter 6

Chapter 6 describes research methods and methodologies and presents results from the empirical data collected in the second macro-cycle. The research methods and methodologies are presented for: a) the analysis of students' performance in online activities; and b) the analysis of students' conceptual understanding of biblical criticism methods.

The *analyses of performance* data include descriptive statistics, Pearson's correlations, and path analysis. Two measured variable path models were proposed for this analysis. Entry-level essay scores were found to be a statistically significant predictor for staff task essay scores, and staff task essay scores were statistically significant predictors both for gospel essay scores and reflection essay scores.

Intern task essay scores did not explain a part of the final scores' variance at a statistically significant level, as was the case with staff task essay scores. An interesting research question suggested by this finding is whether a change in the nature of the intern task to better align its outcome with the outcome from the staff-task would produce a significant increase in the overall fit of the proposed model.

The analysis of *students' conceptual understanding* of biblical criticism methods used a mixed-method analysis with both a quantitative and a qualitative component. The quantitative part of the analysis focused on the closeness between students' conceptual networks with the equivalent expert conceptual network. Descriptive statistics, measures of bivariate association using Pearson's correlations, paired-sample *t* tests, independent-samples *t* tests, and one-way ANOVA with one between-group factor were used in this study. Two measures of the closeness between student' and expert's conceptual networks, the *distance* and *agreement with the expert* for two complementary tasks, were analyzed. Overall, the results from the analysis of the closeness between students' and expert's conceptual networks showed that, when required to recognize associations among concepts in a given set used in biblical criticism methods, students' conceptual networks were significantly closer to the expert's network than when they were required to analyze a gospel passage.

The qualitative part of this analysis discussed some qualitative aspects of students' conceptual understanding of biblical criticism methods. The qualitative findings from both the analysis of students' artifacts produced in a method-driven task and their answers to two open-ended questions provided: a) some support for the quality of students' structural networks; and b) evidence of trends in building over-simplified

conceptual structures. Most of the findings across the two analyses pointed toward factors that support students' tendencies to build over-simplified conceptual structures. On the positive side, this part of the qualitative analysis found that, when reflecting on their gains in understanding from the gospel part of the course, some of the students used concepts that were part of a specific biblical criticism method (e.g. narrative, historical, redaction).

1.4.6 Structure of Chapter 7

Chapter 7 presents a summary of the results and discussions presented here, along with limitations, implications for future research, instruction, and further designs. The main areas in which further research may provide further insights were: a) the complex nature of learning in the field of biblical criticism; b) the design of online scaffolds using cognitive flexibility hypertexts; and c) the Design-Based Research process.

CHAPTER 2

THE EMERGENCE AND DEVELOPMENT OF DESIGN-BASED RESEARCH

2.1 Introduction

Design is one of the most complex types of problems humans face because it requires generation of an original artifact in complex conditions (e.g., Jonassen, 2000b). Because design problems have multiple solutions, designers need to build strong argumentation skills to rationalize their process of choosing a given solution. A design solution needs to address both the technical requirements and restrictions of the contextual field and the requirements of the stakeholders of the solution.

Few designers today have the luxury of creating their own vision with no input from others. If they desire to attract and delight customers for their work, they need to understand the people for whom they design. That used to be much easier. (Ireland, 2003, p. 22).

For example, instructional designers in education need to consider not only the latest developments in learning and teaching, but also to include in their own design factors such as students and their instructors. For the designers to augment their domain-specific knowledge with valid and on-time research information from their stakeholders is critical. These increasing demands have guided designers and researchers in education toward the common goal of finding a methodological bridge between research and design. Research findings can help designers to increase the quality of their solution, but, at the same time, designers can provide researchers with insightful feedback about the utility of their research results, helping them to adapt their methodologies to specific design needs. From a conceptual perspective, design-based research (DBR) builds on formative experiments. Formative experiments are iterative processes that combine factors such as production of classroom materials, and teacher training to develop learning environments suited for both instructional and research activities (A. L. Brown, 1992).

As the field has advanced and learning scientists have worked on creating an identity for this emerging framework of inquiry, the identity of the field evolved from *design experiments* (e.g. A. L. Brown, 1992; Cobb et al., 2003) to *design research* (e.g. Collins, Joseph, & Bielaczyc, 2004; Jonassen, Cernusca, & Ionas, 2007; Laurel, 2003) and respectively *design-based research* (e.g. Barab & Squire, 2004; Design-Based Research Collective, 2003; Sandoval & Bell, 2004).

2.2 The Emergence of Design-Based Research in Education

Design-based research (DBR) is in its infancy. Current attempts to position DBR as a framework for inquiry and to lay out a comprehensive definition for the field are reflective of this nascent state. The Design-Based Research Collective (2003) was the first forum to propose a comprehensive definition of DBR as “an emerging paradigm for the study of learning in context through the systematic design and study of instructional strategies and tools (2003, p. 5)”. However, when the same forum tried to position DBR among other research methodologies the conclusion was:

We do not claim that there is a single design-based research method, but the overarching, explicit concern in design-based research for using methods that link processes of enactment to outcomes has power to generate knowledge that directly applies to educational practice (Design-Based Research Collective, 2003, p.7).

This method-centered approach generated several targeted efforts to: (a) define the design-based research (DBR) process; and (b) to classify various methods developed under this framework of inquiry.

The main line of development, based on the method-centered approach, focuses on the structure of the DBR process. To emphasize the systemic relationship between design, context, and outcome, Cobb (2001) proposed the design research cycle.

The design research cycle is a process that starts with a “thought experiment” that synthesizes the pertinent theories and models in a series of theoretical conjectures (Cobb, 2001, p. 456). According to Cobb, these theoretical conjectures generate the learning trajectory that describes potential means and tools to support meaningful learning. A research trajectory monitors the enactment of the learning trajectory providing feedback on both design and learning factors specific for the given learning context (Cobb, 2001).

From a structural perspective, the design research cycle is made of micro-cycles covering in-class learning tasks which result from the enactment of an embodied conjecture. Micro-cycles are in turn part of overlying macro-cycles which are associated with a unit, quarter, or semester, depending on the nature of the learning activity (Cobb, 2001). The empirical data collected respectively during micro and macro-cycles help the learning scientists to refine the initial conjecture. Empirical refinement of the learning trajectory guides the development of emergent or local theories of learning (Cobb, 2001; The Research-Based Design Collective, 2003).

An alternative structure for the DBR process resulted from merging design processes (e.g. product design, instructional systems design) and research processes (e.g. innovation development, educational research) into an integrative learning design framework (Bannan-Ritland, 2003). Compared to the design research cycle, the integrative framework has both strengths and weaknesses.

One of the main strengths is that it raises awareness about the role of the design activity in shaping the structure and nature of the DBR process. Yet, conversely, the integrative learning design framework has (a) an overemphasized focus on process structure, and (b) a loose focus on the context of the learning activity itself. A contingent line of development based on the method-centered approach focused on the expected outcomes of the DBR process.

To create value, the educational researchers engaged in the enactment of a DBR process that should focus on the development of sharable local theories of learning that go beyond the environmental particulars of a given context (Cobb, 2001; Cobb et al., 2003; Design-Based Research Collective, 2003). The local or prototheories of learning as outcomes represent the leap from traditional formative design to DBR as a paradigm for the study of learning in context.

Finally, the third line of development focuses on analyzing the methodological aspects of the DBR process. The complexity of classroom environments underscores the need to investigate multiple variables, to conduct both qualitative and inductive research, and to have the researcher present in the classroom (A. L. Brown, 1992; Design-Based Research Collective, 2003).

Design-based research relies on techniques used in other research paradigms, like thick descriptive datasets, systematic data analysis of data with carefully defined measures, and consensus building within the field around interpretations of data. (...) A single complex intervention (e.g., a 4-week curriculum sequence) might involve hundreds, if not thousands, of discrete designer, researcher, and teacher decisions - hopefully working in concert – in an attempt to promote innovative practice (Design-Based Research Collective, 2003, p. 7).

Within this framework, finding ways to address reliability and validity issues is a necessary condition for ensuring the scientific quality of the DBR process. Due to the specificity of the DBR process, reliability and validity need to be managed quite differently than in traditional, controlled experiments. For example, triangulation of multiple sources of data can promote the reliability of findings, while increased alignment of theory, design, and practice over time can promote the validity of findings (Design-Based Research Collective, 2003).

2.3 Conceptual and Methodological Developments in Design-Based Research (DBR)

The initial efforts outlined previously focus mainly on positioning the DBR process as a contextual framework of scientific inquiry in the educational research field. Following these efforts, DBR researchers have started to report more in-depth findings and reflections on both the conceptual and methodological aspects of DBR process.

From a conceptual perspective, Tabak (2004) defined the DBR methods as those that “incorporate both design and empirical research with the goal of developing models and understanding of learning in naturalistic environments” (p.226). The need to investigate multiple variables, to conduct both qualitative and inductive research, to have the researcher present in the classroom, and to answer “why” and “how” questions in addition to “what” question, are the main four factors that make DBR methods pertinent to the study of classroom contexts (Tabak, 2004, p.206).

Because of the integration of both design and research in the DBR process, one important theoretical issue is that of the potential conflict between exogenous and endogenous types of design (Tabak, 2004). Exogenous design covers instructional materials and strategies developed to address specific research needs, whereas endogenous design refers to the set of instructional materials and practices already in place in a given instructional setting (p.227).

A design-based research team needs to balance the deterministic tendency of exogenous design grounded in formal instructional design practice and the systemic and fluid requirements of endogenous design grounded in the practice of the classroom. Failure to balance these two complementary forms of designs can generate either a lack of focus on the overall learning trajectory if endogenous design takes precedent, or can significantly limit the overall outcome of the research if exogenous design takes precedent.

From a methodological perspective, Sandoval (2004) introduced embodied conjectures as central to the development and implementation of learning environments. If mapped and experimentally refined, conjectures can serve as the core advantage of design-based research methodology.

The mapping of conjectures also offers a more feasible way to address the relative impact of the learning and research trajectories within the macro and micro-cycles of the DBR process as defined by Cobb (2001). In the initial stage of the DBR process, the learning trajectory embodies the conjectures about learning derived from reported theoretical and empirical data. The embodied conjecture about learning then informs the research trajectory. Once implemented, the research trajectory provides the researcher with new empirical data that can be used to refine the embodied theoretical conjecture. The new learning trajectory will then be based on the contextual characteristics of the learning process. To better represent the complexity of this process, Jonassen et al. (2007) have proposed a multi-layered representation of the design-based research cycle.

Bell (2004) proposes that there are complementary rather than competing accounts of design-based research methods and identifies four main theoretical modes of design-based research, as follows:

- *Developmental psychology design-based research*, a mode of inquiry that focuses on the theoretical and design work such as developmental phenomena, growth in conceptual understanding, or epistemological growth.
- *Cognitive science design-based research*, a mode of inquiry driven by individual approaches in cognitive science such as perception, analogical or schematic reasoning, metacognition, decision making, and problem solving.
- *Cultural psychology design-based research*, that focuses on the cultural mediation of mind and recognizes the significant impact of the surrounding social context as derived from the sociocultural, activity-based theories.

- *Linguistic or cognitive anthropology design-based research* with a focus on how the participants in an educational intervention create meanings as stakeholders engaged in the activities that frame the intervention.

Designers and researchers will often work across paradigms to address the complexity of instructional phenomena. However, these four modes of inquiry should serve as grounds for analyzing the methodological coherence and epistemic integrity issues of design-based research, such as the nature of evidence, threats of validity, or logic of inquiry (Bell, 2004, p.250). One of the main goals of engaging in this approach is to understand how to create innovative learning experiences among learners and at the same time develop new theoretical insights into the nature of the learning process. Indeed, DBR should go beyond using theories and focus on producing “sharable theories that have implications for practitioners and designers with a focus on design in authentic settings” (Jonassen et al., 2007).

2.4 Current Methodological Issues

The main criticism of this stream of research is its inability to funnel “a loose set of methods into a rigorous methodology” (Kelly, 2004, p.116). To move from “under-conceptualized” and “over-methodologized” DBR, learning scientists need to strive toward a more mature methodology (Dede, 2004, p. 107). Several important issues are rooted in this main methodological weakness.

Addressing issues such as argumentative grammar, problem demarcation, problem generalization, and meaningfulness are some first steps toward a rigorous methodology (Kelly, 2004). For example, there is a lack of guidance rules regarding the data to collect or ignore in a DBR study (Kelly, 2004). According to Dede (2004), another possible threat for the quality of DBR outcomes is the complex “cognitive ecology” of the DBR teams.

The tendency of designers to rely on artifacts and innovation may push the researcher to find problems for predetermined, designed “solutions” (Dede, 2004, p.107).

Another important methodological aspect is the lack of clear quality standards that could help both researchers and practitioners decide if and when to abandon a given design (Dede, 2004). Without such standards, “the DBR field risks being seen as a venue for suboptimal educational strategies endlessly tweaked by their proponents in hopes of an unlikely breakthrough”(Dede, 2004, p. 108).

2.5 Conclusion

An analysis of the literature for this emergent stage of design-based research (DBR) revealed that this new paradigm of educational inquiry has reached a critical mass of research results, capable of stimulating the emergence of a scientific community to support its expansion. The Design-Based Research Collective (2003) both as a group and through the voices of its individual members have positioned DBR at this stage as a viable framework for understanding how theoretical claims about contextual learning can become effective learning and teaching strategies.

The emergence of DBR as a coherent inquiry framework was the basis of my engagement in a DBR process during the Fall Semester of 2003. The overall goal was to analyze the impact of DBR as a research framework on the design and implementation of technology-rich learning environments in complex domains. This study builds on the opportunity to develop and implement an online learning environment in the field of biblical criticism. The opportunity to conduct this research emerged at the University of Missouri during the Spring Semester of 2002, when a group of faculty and graduate students from the Learning Sciences Institute engaged in a long-term relationship with the instructor of the Introduction to the New Testament course.

The next four chapters will describe the theoretical grounds for the initial development of the learning environment and respectively the refinement of the initial design into a DBR process with two macro-cycles (Figure 2.1).

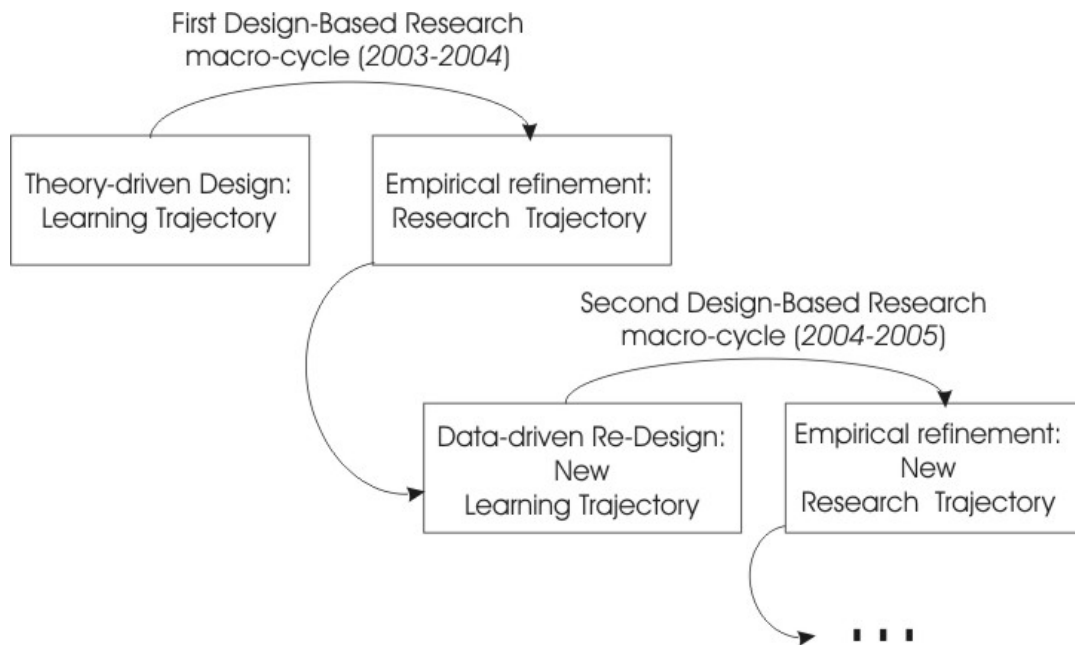


Figure 2.1 The Design-Based Research cycle for the Introduction to the New Testament course (Adapted from Cobb, 2001)

CHAPTER 3

THE THEORY-DRIVEN DESIGN OF AN INNOVATIVE LEARNING ENVIRONMENT

Following the model proposed by Cobb (2001), the design-based research (DBR) process for this study started with the theory-driven design stage (Figure 3.1).

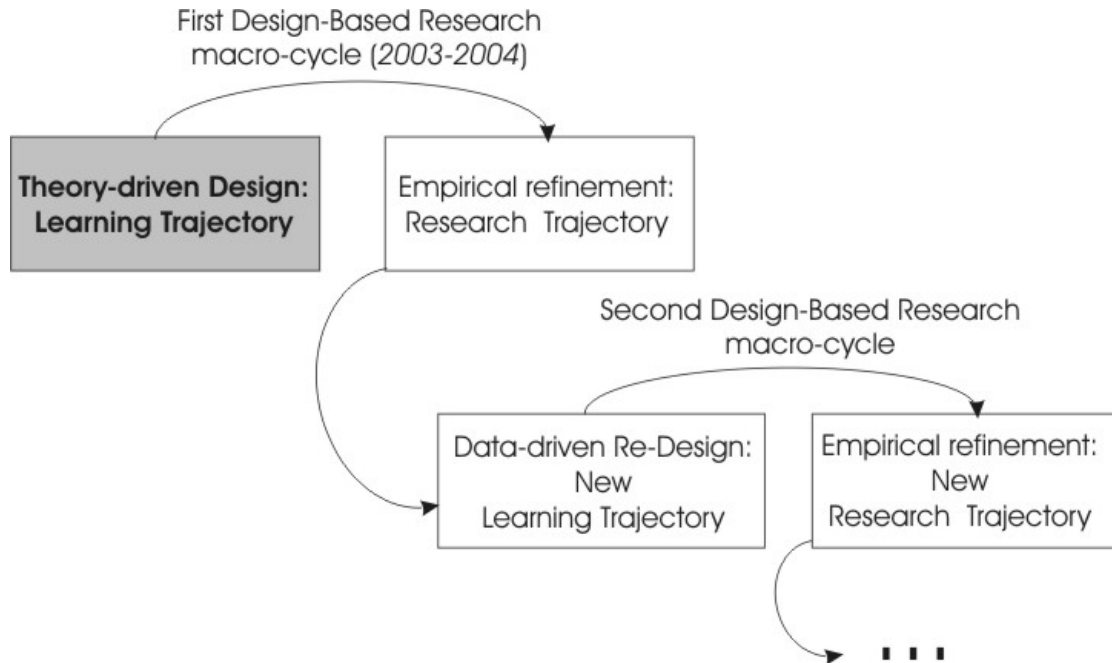


Figure 3.1 The theory-driven design step in the first design-based research macro-cycle

The theory-driven design stage involved two major steps. First, the pertinent theories and models that addressed identified learning gaps in a target learning activity were synthesized in a series of theoretical conjectures. In the second step, two learning environments were designed to embody the proposed theoretical conjectures about learning. This chapter describes the operationalization of these two steps in the theory-driven design stage for the Introduction to the New Testament course.

3.1 Biblical Criticism: An Expanding Ill-Structured Field in Religious Education

In the most generic sense, biblical criticism is comprised of a relatively large number of methodologies aimed to study the Scripture by applying “neutral, i.e., scientific and nonsectarian, canons of judgment in its investigation of the biblical texts” (Soulén & Soulén, 2001, p. 18). Assimilated for a long time with the historical criticism method (e.g. Miller, 1993), biblical criticism today hosts a wealth of distinguishable, yet interrelated, methods adopted from fields such as literary criticism, social involvement, or postmodern criticism (Soulén & Soulén, 2001). Methods such as redaction criticism, feminist interpretation, or postmodern biblical interpretation offer new perspectives to the meanings derived from the Scriptures through a traditional historical perspective.

The complexity added to the debate in the field as a result of these methods has often created frustrating experiences among scholars engaged in the teaching of biblical criticism (Haynes & McKenzie, 1993). In time, these frustrations fueled the need among religion educators to find ways to address the gap between biblical criticism as scholarly academic field and its integration in the undergraduate classrooms.

[An important challenge is that of] bringing the Bible to life for undergraduates. It did not take long to realize that these students were only likely to show interest in biblical criticism if its value could be demonstrated in action – if they could be convinced, that is, that biblical criticism shed light upon texts that appear difficult or incomprehensible (McKenzie & Haynes, 1999, p. 6).

3.2 Application Field: The Introduction to the New Testament Course

The opportunity to bring biblical criticism to life in the undergraduate classroom emerged during the Spring Semester of 2002. At that time at the University of Missouri, a group of faculty and graduate students engaged in a long-term relationship with the instructor of the Introduction to the New Testament course which created the conditions to engage in the design-based research (DBR) process.

The main goal of the Introduction to the New Testament course was to foster a lifelong interaction with the texts in the New Testament and create a platform for reflection on the general nature of human religiosity. The course content covered: a) the Gospel texts, b) several major non-Gospel texts, and c) models of understanding Jesus. Historical criticism is the core criticism perspective used throughout these three components.

The course had a heterogeneous group of about 150 students, ranging from sophomores to seniors and coming from various schools and colleges across the university. To address the instructional needs of this large and heterogeneous student body, two graduate students recruited from the Religious Studies department helped the instructor throughout the entire course.

The teaching team used a combination of instructional tools that consist of: a) lectures augmented with PowerPoint presentations and instructor-initiated short dialogues; b) small-group activities which covered topics that complement and reinforce the content of the lectures; and c) an online course management package (WebCT) that served both as a repository for student assignments and as a communication tool.

3.3 Theoretical Conjectures: Theoretical Models of Learning of Biblical Criticism

The next step in the DBR cycle (Cobb, 2001) involved the analysis of the pertinent theoretical frameworks and models that could help close the gap between biblical criticism as a scholarly academic field and its application in the target undergraduate course.

3.3.1 Biblical Criticism Methods: Selection and Structure

3.3.1.1 Selection of the Target Instructional Tasks

The faculty coordinator of the course, a member of the design-based research team, assumed at this stage the role of a subject matter expert (SME). The interaction of the SME with the research team started with the identification of the critical instructional tasks to maximize the impact of biblical criticism methods on students' learning outcomes. From the three major components of the course content (the Gospel texts, the non-Gospel texts, and models of understanding of Jesus) the interpretation of the Gospel texts was considered most critical. Two main reasons sustained this conclusion. First, the analyses of Gospel texts help students build text interpretation skills critical for the other two course components. Second, the structure of the Gospel texts, the narration, makes them the best fit for both the individual and comparative critical analyses involved in biblical criticism. Following this rationale, the decision was then to focus the design analysis on the Gospel interpretation tasks and to place this group of tasks at the beginning of the course.

Considering that biblical criticism covers more than twenty methods (Soulen & Soulen, 2001) , the next input from the instructor at this stage of the study was the selection of those biblical criticism methods that meet the goals of this course.

The two factors that bounded this decision were: 1) the introductory nature of the course; and 2) the temporal limitation of instructional tasks to the first third of the fourteen-week semester. These factors limited both the breadth and depth of the chosen methods. Students were exposed to four biblical criticism methods of which one was to be studied in-depth.

The four methods chosen were *historical criticism*, *redaction criticism*, *narrative criticism*, and *feminist biblical interpretation*. These four methods cover the entire spectrum of the biblical criticism analysis (see Figure 3.2), from focusing on the sources of information, to the text, to the receiver, and to the interpreter (Soulén & Soulén, 2001).

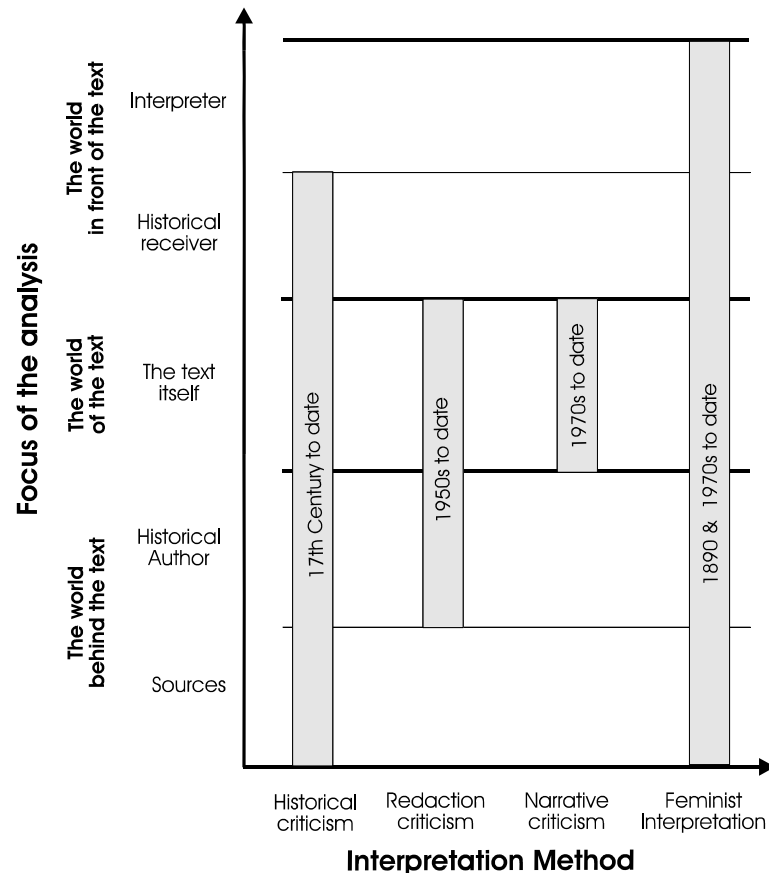


Figure 3.2 Current perspectives of biblical criticism (Adapted from Soulén & Soulén, 2001)

3.3.1.2 Structure of the Biblical Criticism Tasks

To adapt the level of analysis to both the introductory scope of the course and the wide range of knowledge and skills of the student body, the subject matter expert distilled each method in a series of basic questions that guided the method-specific inquiry process.

3.3.1.2.1 Historical Criticism. Often considered as synonymous to the entire body of critical methodologies, historical criticism “seeks to understand the ancient text in light of its historical origins, the time and place in which it was written, its sources, if any, the events, dates, persons, places, things, customs, etc., mentioned or implied in the text (Soulén & Soulén, 2001, p. 79)”. Its wide span of focus on ancient texts, from their historical inception to their historical receiver is praised for its objectivity, which ushered the use of scientific inquiry in the understanding of the Bible. The basic questions developed by the SME to guide students’ historical inquiry process cover five criteria as described in Table 3.1.

Table 3.1

Basic Questions to Guide Historical Inquiry of Gospel Texts

Criterion	Sample Questions
<i>source attestation</i>	Does this text have multiple independent attestations?
<i>distinctiveness</i>	Does the text say that Jesus said or did something that nobody else in this time would have done?
<i>embarrassment</i>	Would the early churches have been embarrassed by this?
<i>coherence</i>	Does this story accurately reflect first century history and culture?
<i>historical probability</i>	On the basis of these criteria, does the text have high, medium, or low historical probability?

3.3.1.2.2 Redaction Criticism. As method, redaction criticism “seeks to lay bare the historical and theological perspectives of a biblical writer by analyzing the editorial (redactional) and compositional techniques and interpretations employed in shaping and framing the written and/or ORAL TRADITIONS (sic) at hand (Soulén & Soulén, 2001, p. 158)”. The focus of redaction criticism is the relation between the historical author and the text itself. This approach brings to life several questions about the precedence and authenticity of the information in a given biblical text.

Redaction criticism also fosters new perspectives about what role the social situation of both the author and his intended audience played in the shaping of the text at hand. These characteristics are synthesized in the basic questions developed by the SME to guide students' redaction inquiry (Table 3.2).

Table 3.2

Basic Questions to Guide Redaction Inquiry of Gospel Texts

Criterion	Sample Questions
<i>precedence</i>	What sources did the redactor use? Which version is a cover? Is there more than one cover?
<i>content</i>	What the redactor add, delete, or reuse to/from the traditional version?
<i>authenticity</i>	Is the authentic version the one we analyze? Is the authentic version the most popular one?
<i>social settings</i>	What does the new version tell about the redactor's social situation? How do the differences made by the redactor affect the overall impact of the text?

3.3.1.2.3 Narrative Criticism. The main statement of *narrative criticism* is that stories are fundamental forms to convey the meanings of human existence across time and generations.

The focus on the story in a given biblical text allows the analyst to reveal the events that occur, to identify spatial and temporal settings of these events, and to make informed assertions about the social location and values associated with them (e.g. Soulen & Soulen, 2001). Table 3.3 presents in a synthetic manner the structure of the narrative inquiry as proposed by the SME.

3.3.1.2.4 Feminist Biblical Interpretation. Given that both redaction and narrative inquiry trade breadth for depth of analysis, feminist interpretation expands the focus of analysis by including the interpreters and their social goals (see Figure 3.2).

Engaging in a feminist biblical spirituality, therefore, means learning how to read/understand the bible from the standpoint of a feminist theory of justice and a feminist movement for change. Hence, feminist scholars and activists in religion have developed new ways of interpreting the bible (and other culturally influential texts) in order to prevent biblical knowledge from being produced in the interest of domination and injustice (Schussler Fiorenza, 2001, p. 2).

Table 3.3

Basic Questions to Guide Narrative Inquiry of Gospel Texts

Criterion	Sample Questions
<i>characters</i>	Who is the main character? Who are main character's opponents and allies?
<i>mission</i>	What mission does the main character attempt to accomplish?
<i>conflict development</i>	What conflicts develop that threatens to thwart that mission?
<i>conflict resolution</i>	How the conflict is resolved?
<i>character complexity</i>	Does the story propose a stock, flat, or round main character?

The main aim of the feminist perspective is to expose the patriarchal character of biblical literature and then to reject the androcentric perspective which represents women as derivative.

The fundamental question faced by feminist interpreters of the Bible concerns the role and the status of the Bible itself as a source and norm of faith. Should the Bible be viewed with suspicion as an oppressive product of a patriarchal culture or be recovered as a source of authority, empowerment, and belief? (Soulén & Soulén, 2001, p. 59)

Two other complementary issues emerge from the focal aim of feminist inquiry. First, the feminist analysts aim to show the discrimination against women that is only implied by the traditional forms of criticism. Second, the feminist critics aim to secure for women an equal right to self-determination within the domain of biblical scholarship (Soulén & Soulén, 2001). The basic questions developed by the SME to guide students' feminist interpretation of biblical texts cover four main criteria as described in Table 3.4.

Table 3.4

Basic Questions to Guide Feminist Interpretation of Gospel Texts

Criterion	Sample Questions
<i>involvement</i>	In what way are women involved in the text? Where are the women?
<i>action</i>	Are women silent? Are they role models or are they treated negatively?
<i>danger</i>	What effect does it have to read these stories today? Are they dangerous to women?
<i>liberation</i>	Does this gospel text promote liberation of contemporary women and men?

Cognitive Flexibility Theory is the theoretical approach that is most closely aligned with biblical criticism methodologies and that provides a series of instructional tools to address the complexity of this field (e.g. Spiro et al., 1988; Spiro et al., 1991; Spiro et al., 1995). Cognitive Flexibility Hypertexts (e.g. Spiro & Jehng, 1990) as instructional tools of Cognitive Flexibility Theory are well-suited to represent alternative interpretations such as those proposed by the four interpretation methods used for target instructional tasks.

3.3.1.3 The Impact of Biblical Criticism Tasks on the Overall Instructional Process

As mentioned in the brief description of the course above, course content covered three major instructional segments: a) the Gospel texts, b) several major non-Gospel texts (e.g. letters to Paul), and c) models of understanding of Jesus. Timewise, each of these three segments covered about one third of the fourteen-week Winter semester. From a content perspective, the main difference among the three segments was the nature of the texts students were required to interpret. The Gospel texts are narratives written for a wider audience and thus are well-suited for a wide range of biblical criticism analyses.

These texts were placed first in the course to help students build basic text interpretation skills from various contextual perspectives. The other two sections of the course had more focused texts which could build on the basic text interpretation skills that students constructed during the Gospel section of the course.

Another major aspect related to the structure of the instructional process was the nature of scaffolds used to support students' learning across the three major sections of the course. In terms of similarities, all three sections used both face-to-face lectures and small-group discussions as scaffolding tools. WebCT was also used as the course management system for all three sections. The major difference across the three sections was the addition of a Cognitive Flexibility Hypertext (CFH) in the Gospel section to scaffold in-depth learning of biblical criticism methods. This CFH provided an individual scaffold for students' learning which significantly differentiated the structure of the learning activities in the first segment from the structure of the other two segments in the instructional process.

3.3.2 Cognitive Flexibility Theory: Knowledge Acquisition in Ill Structured Domains

Cognitive Flexibility Theory (CFT) emerged as a strategy that targeted the main sources of misunderstanding among learners engaged in advanced knowledge acquisition in ill-structured domains (Spiro et al., 1988; Spiro et al., 1987). Initially, CFT was clearly and strongly positioned as an instructional strategy “for advanced learners striving to master complexity and prepare for transfer in ill-structured knowledge domains” (Spiro & Jehng, 1990, p. 173).

However, later on, Spiro and his colleagues proposed that CFT applies to the transfer of basic abstract concepts to naturally occurring situations in domains otherwise perceived as well-structured (Spiro et al., 1991; Spiro et al., 1995).

3.3.2.1 Operational Structure of Cognitive Flexibility Theory

The main tenets of CFT (Spiro et al., 1988) are: a) avoidance of oversimplified instruction; b) multiple representations of the content; c) emphasis on case-based instruction; d) support for context-dependent knowledge; and e) support for complexity. To support the required flexibility of cognitive process, CFT builds metaphorical *cognitive landscapes* of the given ill-structured domain. These landscapes are then *thematically criss-crossed* by the learners which *selectively* use knowledge that *adaptively fit* the needs of the problem to solve, and creates adaptive *knowledge assembly* (Spiro et al., 1988; Spiro et al., 1987).

The main strength of CFT is its ability to offer an operational structure that helps both researcher and practitioners to apply its metaphorical structure in the practice of instruction. Three main steps can help the researcher to implement an instructional environment that follows the tenets of CFT. First, groups of *compact cases with partial overlap* need to be selected as part of the context of the cognitive landscape proposed to the learner (Spiro et al., 1987). Case-based instruction will move learners from abstract exposure to concepts to immersion in the use of those concepts. The use of multiple, overlapping cases take the same learners one step further and engages them in the flexibility of concept use inherent in ill-structured domains (Spiro & Jehng, 1990; Spiro et al., 1987).

Second, a thorough coding of these cases will help the researcher to: (a) identify *themes* and perspectives that focus on knowledge in use specific for that domain; and (b) *generate mini-cases* associated with the major themes identified. On the one hand, themes provide learners with cognitive scaffolds that help them combine multiple representation of the same complex domain in *knowledge assemblies* as they criss-cross that landscape. On the other hand, the use of multiple mini-cases helps both to cover the complexity of ill-structured domains and to accelerate knowledge acquisition by offering *manageable chunks of information* (Spiro et al., 1988; Spiro & Jehng, 1990).

Finally, a theory-based hypertext system combines the power of case-based cognitive landscape scaffolds with that of the random access to information afforded by the hypertext. The *Cognitive Flexibility Hypertexts* (CFHs), as they are referred to in the literature, are non-linear computer learning environments that allow learners to visit the same material at different times and in rearranged contexts, to serve multiple purposes and conceptual perspectives (e.g. Spiro et al., 1988; Spiro & Jehng, 1990; Spiro et al., 1987).

One important observation is that technical issues are not the core factors associated with CFHs; rather, their affordances allow for the creation of specialized functions based on the structural characteristics of the cases used to build them (Duffy & Jonassen, 1992; Jacobson, Maouri, Mishra, & Kolar, 1996; Spiro & Jehng, 1990). Non-linear nodal links made of themes, their associated perspectives, and scaffolding or tutoring aids build the thematic criss-crossing that guides (but does not restrict) navigation within CFHs.

The guidance offered by the thematic criss-crossing of the contextual landscape helps learners to reduce navigational frustrations endemic of random access hypertexts as well as to create multiple schemas as they move from one case to another that has a similar instance of the same conceptual structure. The combination of low frustration and multiple complementary schemas help learners build *adaptive knowledge assembly*, one of the major strengths of this instructional approach (Spiro et al., 1995).

3.3.2.2 Empirical Research on Cognitive Flexibility Theory

The well-developed operational structure of CFT made its application a very strong candidate for empirical research. Table 3.5 summarizes the main lines of experimental research both on the instructional effectiveness of Cognitive Flexibility Hypertexts and on their interaction with students' characteristics.

The empirical data resulting from experimental research converge toward the conclusion that when compared to traditional textbook scaffolds, cognitive flexibility hypertexts (CFHs) provide significantly better transfer of learning for complex tasks such as problem solving, analysis, or synthesis.

For acquisition of introductory domain knowledge such as recall and recognition, however, results show a *split* between a negative impact and no hindering of learning with a *tendency* to support the former effect (the lack of negative impact). The divergence of research results is also specific to the impact of epistemological beliefs on learning with CFHs, with a *strong tendency* to sustain the positive impact of the interaction between complex tasks and complex epistemic beliefs on the transfer to new tasks.

Table 3.5

Empirical Research on Cognitive Flexibility Theory

Main focus	Author(s) & Context	Main Findings
Comparative Transfer	(Spiro et al., 1987) Two Experiments. High school students exposed to CFHs and respectively linear descriptions around 20 th Century Events.	- well structured scaffolding provided better conditions for recall. CFT provided significantly better transfer of knowledge to new tasks on six transfer measures;
	(Demetriadis & Pombortsis, 1999) Experiment with first and second year college students, <i>novices</i> in Computer Networking field; students were exposed to CFHs versus linear Electronic Book.	- carefully structured case based instruction for novice students (i.e., cognitive flexibility hypertext) enhances flexibility in learning while it <i>does not hinder acquisition of introductory domain knowledge</i> ;
Epistemic Beliefs	(Jacobson & Spiro, 1995) Freshmen and Sophomore university students exposed to Thematic Criss-Crossing hypertext versus Minimal Hypertext/Drill on the topic of Technology and the 20 th Century: Impact on Society and Culture. The Epistemic Beliefs and Preferences (EBP) tool used.	- <i>no significant correlation</i> between the EBP and vocabulary test; - subjects with complex EBP who received CFT treatment <i>scored significantly higher</i> on problem solving essay tasks;
	(Jacobson et al., 1996) Follow up of (Jacobson & Spiro, 1995) study that compares Guided Thematic Criss-Crossing (GTCC) to Learner Selected Criss-Crossing and to Free Hypertext Exploration. An improved version of the Epistemic Beliefs and Preferences (EBP) tool used.	- students with <i>complex EBP</i> in the GTCC group scored <i>significantly higher</i> on the knowledge synthesis than all other groups; - <i>complex EBP</i> students wrote <i>better problem-solving essays</i> averaged across all test sessions;
	(Demetriadis & Pombortsis, 1999) Experiment with first and second year college students, <i>novices</i> in Computer Networking field; students were exposed to CFHs versus linear Electronic Book. Used an Epistemic Beliefs and Preferences (EBP) tool adapted from Schommer.	- treatment appeared to have <i>significant effects</i> on Flexibility items (solve more complex problems) <i>independent of students' EBP scores</i> ;
IQ and Prior Knowledge,	(Jang, 2000) High school Korean students enrolled in a history course were exposed on Cognitive Flexibility Hypertexts (CFHs), versus Hierarchical Hypertext and versus textbook instruction.	- no significant differences for recall questions; - overall, CFHs group performed significantly better than other two groups especially on analysis and synthesis; - <i>high IQ x low Prior Knowledge</i> the only group that <i>improved significantly</i> from pre to posttest;

3.3.2.3 Cognitive Flexibility Hypertext: A Theory-Driven Tool for Contextual Instruction

Cognitive Flexibility Hypertext was a very strong candidate as instructional tool for the Introduction to the New Testament course. On the one hand, the nonlinear structure of hypertexts allow for a degree of self-control that fosters learner engagement (e.g. Jacobson et al., 1996; Jang, 2000; Jonassen et al., 1997). On the other hand, the nonlinear structure of hypertexts allows the mapping of thematic criss-crossing of the conceptual landscape, as described by the theoretical models of learning that describe the instructional context (e.g. Jacobson & Spiro, 1995; Spiro et al., 1991).

3.4 Design Conjecture: Initial Development of Learning Trajectory

From a design perspective, Cognitive Flexibility Hypertexts (CFHs) are able to: a) operationalize the complexity of the four biblical criticism methods; and b) stimulate students to engage in meaningful learning activities. The DBR team reviewed existing instructional requirements and regulations and identified three major design constraints. The CFHs that were intended to operationalize the complexity of the four biblical criticism methods would need to: a) retain the current length of instructional activities while imbuing additional complexity into the instructional tasks; b) maintain the extant ratio of instructors-to-students while engaging students in contextual meaning-making; and c) accommodate a diverse student body with minimal direct additional support from the instructors.

The DBR team proposed an online learning environment (OLE) that started with walking students through the inquiry process of all four methods and then anchored the instructional tasks in a series of activities specific for one of these four methods.

The goal of the online instructional tasks was to help each student to know one of the methods in-depth and become an active advocate of that method during small group and whole class discussions. Online access facilitated both the individual access and the convenience of access to the instructional material with minimal additional support from the instructors. Use of the inquiry structures proposed for each method provided conceptual scaffolding for instructional tasks anchored in activities that were specific to each method. Finally, a series of metaphors guided the criss-crossing of the inquiry landscapes for both overall and method-specific navigation.

3.4.1 Metaphors and Their Embodiment

The design-based research team used a three-layer metaphor approach to guide students through the structure of the learning environment. The main metaphor suggested by the overall context of the learning activity was that of a summer camp. The camp, called Camp Hermeneutica, had a natural appeal for the target audience, and at the same time allowed the needed flexibility to include the four criticism methods in a unitary situational framework. The second metaphorical layer was that of an optometrist office with a dual role. In this layer, four pairs of differently colored eyeglasses exposed students to both the nature and basic structure of each method. Since health checking is a required task for any camper, the first role of this metaphor was to quickly introduce students to all four biblical criticism methods. The second role of this introductory task was to guide students in making informed decisions about which method to study in-depth as part of their virtual activity. The outcome of this task was students' choice of a given pair of glasses, i.e., a specific method.

To ensure a relatively uniform distribution of students to all four methods, the optometrists (the instructor in this case) had a pre-defined number of available eyeglasses for each of the four colors. This restriction motivated students to fully engage in the task as soon as possible in order to be able to get their preferred criticism method. The third metaphorical layer included four types of camp-organized activities, one for each method: (a) the theater for narrative criticism; (b) the newspaper for feminist interpretation; (c) the radio for redaction criticism, and (d) the activity field for historical criticism.

The multilayered metaphorical approach was favored by the instructor as it opened the possibility to both add future criticism methods for Gospel interpretation and to expand the environment for other types biblical texts used in the course.

3.4.2 The Structure of Instructional Tasks

Each of the four activities had the role of *anchoring the learner* in an engaging sequence of tasks built around the inquiry framework proposed by the instructor for each criticism method. In deciding on the nature and the structure of the tasks within each of the four activities the design team considered several factors: (a) the complexity of the Gospel texts; (b) the potential that students have their own personal perspective of Gospel texts, and (c) the diversity of the student body.

To address the complexity of the texts and any potential resistance to new perspectives for interpreting these texts, the designers introduced students to two perspectives of inquiry for each method. The introductory perspective was a modern-day activity that used the method-specific inquiry framework, followed by a switch to the perspective of a biblical critic that uses that specific method.

The four modern-day perspectives were: 1) the movie critic for narrative analysis; 2) the music analyst for redaction criticism; 3) the newspaper editor for feminist interpretation; and 4) the outdoors-loving camper for historical interpretation.

To address the large spectrum of knowledge and skills held by the diverse student body, both the modern-day activity and the Gospel interpretation activity included worked examples. For each method, the worked examples used the specific inquiry structure provided by the instructor and offered quick predefined expert feedback that allowed students to reflect on the nature and focus of the inquiry process for that contextual perspective. For the Gospel section of the course, students were able to practice a similar inquiry structure on multiple Gospel short texts pertinent for each method.

The main artifacts that resulted from the online activities were a short essay that covered the introductory non-Gospel tasks and a major Gospel essay that concluded the online, method-driven Gospel tasks. The feedback provided by the instructors for the first artifact was short and targeted the major weaknesses of interpretation, if any, while the feedback for the Gospel essay was extensive. The feedback for the online Gospel essay had a clear formative role in preparing students for a midterm exam that covered the Gospel segment.

Appendix A presents more details regarding the technical aspects, general navigation, as well as specific tasks for one of the four methods. The appendix also includes screenshots from the Camp Hermeneutica online learning environment.

3.5 Formative Implementation of Camp Hermeneutica: Changing Metaphors

Due to the novelty of the proposed instructional process, the instructor decided to run a full implementation of the new format of the course during the Spring Semester of 2003. The implementation of a formal research program to monitor this implementation was postponed. Both the instructor and the teaching assistants focused on the organizational challenges posed by the implementation of the online learning environment and on its impact on the face-to-face (classroom) activities in the first third of the course.

3.5.1 The Impact of Online Learning Environment on Classroom Tasks

The introduction of a new instructional tool requires adjustments to the existing structure of learning activities to reflect the new complexity of the instructional process.

First, because the course used WebCT as the main course management platform, the instructor required students to post the artifacts resulting from Camp Hermeneutica tasks to both the assignment section and to the dedicated discussion boards in WebCT. The availability of essays in the discussion boards created the opportunity for all students to exchange ideas across methods.

Second, the instructor used the four biblical criticism methods in small-group classroom activities. Students split into four homogeneous teams based on the method they chose to work with in the online learning environment. Upon analysis of text used in the small-group activities, one representative from each team presented a short synthesis of their team's perspective. In this way, the students were given the opportunity to reflect both on the specificity and similarity of the four methods.

Third, in addition to direct contact with students in small-group discussions and during lectures, the instructor created a general discussion board in WebCT to allow students to post issues related to both the face-to-face and online tasks.

3.5.2 Design Conclusions from the Formative Implementation

Based on the feedback from lecture, small group discussions, students' postings on the general discussion boards, and discussions with teaching assistants, the instructor formulated some design-related conclusions. Some of the major strengths of using Camp Hermeneutica were: a) the convenience of anytime access to the environment; b) increased engagement of students in small group discussions; and c) more uniform quality in student performance. The main weaknesses of Camp Hermeneutica were: a) navigational problems reported by some students due to the three-layered metaphorical structure; b) a disproportionate amount of effort from both students and instructors required for the completion of the field activity (historical criticism) as compared to the other three methods.

3.5.3 Changing Metaphors: From Camp Hermeneutica to Cinema Hermeneutica

Based on the design-related conclusions of the formative evaluation, the instructor reduced the layered metaphors to only two: a) the activity metaphor; and b) the method-based task metaphor. Also, to better indicate the unity of the four complementary methods within the field of biblical criticism, the new environment used only one metaphor for the method-based instructional tasks.

The *activity metaphor* was extrapolated from the task metaphor of the cinema used in Camp Hermeneutica for narrative criticism.

The new metaphor was that of a temporary job as movie reviewer which drove the change of the name to *Cinema Hermeneutica*. Under this activity metaphor, the job counseling tasks were used to expose students to the nature and basic structure of all four criticism methods.

The *second layer of metaphors* was that of four method-driven specialized magazines: a) “Tales Told” literary magazine specialized in narrative criticism; b) “One More Time” recycling magazine specialized in redaction criticism; c) “Wo/men” magazine specialized in feminist interpretation; and d) “Just the Facts” history magazine specialized in historical criticism. The structure of the instructional tasks was the same for each of the four methods and included: 1) a visit to the cinema lobby where the inquiry structure of the method was exemplified in a fully worked example; 2) the review of pre-selected movies for which the students practiced the method-specific questions and got instant, pre-determined expert feedback; 3) the review of a movie at the choice of the student using the method practiced in the previous step; 4) a review of several Gospels following the same structure of pre-determined expert feedback as for the pre-selected movies; and 5) a full analysis of a Gospel text using the chosen method.

Out of these five tasks only the third and the fifth ones (movie review and full text Gospel analysis, respectively) required students to produce artifacts for grading purposes. The first artifact was a short essay that covered the movie critic task, and the second one was a major Gospel essay that concluded the online Gospel tasks. The feedback provided by the instructors for the first artifact was short and targeted the major weaknesses of interpretation, if any.

The feedback for the online essay Gospel was extensive with a clear formative role in preparing students for the midterm exam which covered the entire Gospel analysis and included a similar Gospel essay.

Appendix B presents more details regarding the technical aspects, general navigation, as well as specific tasks for one of the four methods. In addition, screenshots from the Cinema Hermeneutica hypertext are also available there.

3.6 Conclusions

The outcome of the first stage in the DBR cycle was an improved instructional activity that built on the synergy between theoretical and design models from the fields of both biblical criticism and learning science. The resulting instructional activity included: a) a series of new instructional tasks derived from four biblical criticism methods; b) a theory-driven cognitive flexibility hypertext that embodies the new instructional tasks; and c) improvements that reflected the complexity of the new learning tasks to face-to-face tasks, lectures, and small-group discussions.

The formative implementation of the initial learning environment provided quick feedback on the major design weaknesses that hindered students' use of this new instructional tool. At the same time, the initial implementation failed to provide evidence of students' learning with this new tool. Because the instructor was confident that the overall quality of students' performance increased when using these learning environments he agreed to fully engage in the next stage of the design-based research cycle in which the learning environment is refined based on empirical research data.

CHAPTER 4

CINEMA HEREMENEUTICA: REFINING STAGE OF THE FIRST MACRO-CYCLE

In the first stage of the current macro-cycle, the design-based research (DBR) team proposed an innovative learning trajectory that synthesized the theoretical conjectures of both biblical criticism and of the learning sciences. The focus was the online learning environment, Cinema Hermeneutica. It embodied new instructional tasks derived from four biblical criticism methods in a cognitive flexibility hypertext (CFH) (Figure 4.1).

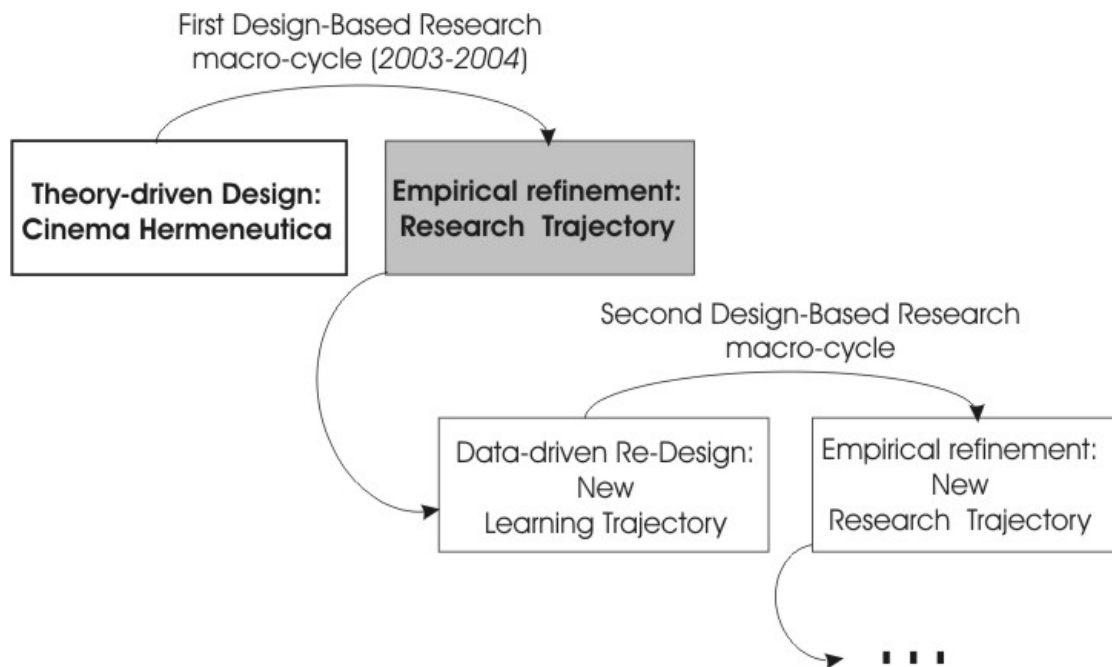


Figure 4.1 The Empirical refinement of the first Learning Trajectory

The next stage in the macro-cycle was the empirical refinement of the proposed learning trajectory through a research trajectory that monitored the learning trajectory's implementation in an actual classroom setting.(e.g. Cobb, 2001).

4.1 Research Trajectory for the First Macro-cycle

The review of the literature showed significant effort associated with the research on Cognitive Flexibility Theory (CFT). Empirical research on CFT focuses on transfer of knowledge to new tasks (Demetriadis & Pombortsis, 1999; Spiro et al., 1987) and the impact of students' epistemic beliefs (Demetriadis & Pombortsis, 1999; Jacobson et al., 1996; Jacobson & Spiro, 1995), IQ, and prior knowledge (Jang, 2000). CFT was found to support a wide range of prior knowledge. The impact of CFT on transfer of knowledge to new tasks was significant for both advanced learners (Spiro et al., 1987) and novices (Demetriadis & Pombortsis, 1999).

The interaction between CFT and epistemic beliefs on the other hand produced results that were less consistent than those related to prior knowledge. Jacobson and colleagues (1995, 1996) found that participants in a CFT treatment who had complex epistemic belief structures scored higher on both problem solving essays and knowledge synthesis tasks, while Demetriadis et al. (1999) found a significant positive effect on problem solving tasks for all epistemic beliefs groups. More recently, Jang (2000) found that CFT groups performed significantly better on analysis and synthesis activities than non-CFT groups, regardless of their prior knowledge level, and that the High IQ x Low Prior Knowledge group was the only one that improved significantly from pretest to posttest.

The above studies were designed as experiments that exposed subjects to relatively short-term treatments outside of some formal instructional process. This research approach is very powerful in explaining contrasting treatments but ignores the impact of CFT on the learning processes specific to long-term instruction.

As a first step in addressing this gap, the major goal of the research in the first DBR macro-cycle was to explore the impact of integrating a CFT-driven learning environment, Cinema Hermeneutica in this case, in the learning process associated with the Gospel section of the Introduction to the New Testament course.

4.1.1 Research Questions

Due to the exploratory nature of this study, three broad research questions focusing on students' performance on transfer tasks were followed:

1. Does the instructional process that includes Cinema Hermeneutica have a significant overall positive impact on learning as reflected in students' performance outcome on transfer tasks?
2. How do the types of instructional tasks simulated in the biblical criticism methods, part of Cinema Hermeneutica, impact students' performance outcome on transfer tasks?
3. How well does the instructional process that includes Cinema Hermeneutica address students' diversity as measured through their: a) major; b) epistemic beliefs level; and c) entry-level skills?

4.1.2 Constraints to the research process

One of the major constraints in selecting a research design was the requirement to expose all students to the same instructional process. Cinema Hermeneutica was built as an important component of the improved Gospel Analysis section of the course. The possibility of ethical issues arising that were associated with selective implementation of these new instructional tasks was considered high. This constraint eliminated the possibility to use a control group for this research.

A second important constraint was the lack of control of students' use of the environment for completing the assigned tasks. The HTML-based environment was an open-ended navigation structure with two major weaknesses: a) the environment did not require login, and b) it did not offer the possibility to verify completion of instructional tasks. The main assumption used in this research stage was that the nature of each task constrained students to use all or most of the scaffolds built in the environment to complete a given task.

The third constraint was that measurement of students' performance was done outside the flow of the regular course of instruction through voluntary assessment activities that were rewarded with extra points. One consequence of this constraint was the threat of attracting primarily high achievers interested in securing a high grade at the end of the course. However, because this course was an elective and not a required general education course, the assumption was that most of the students enrolled in this course were motivated to complete it with a high grade. Another consequence of this constraint was the limitation of the complexity of the transfer tasks used to measure students' performance. That is, the transfer tasks were minimal, as students were rewarded with extra points allocated for participating in this study. Based on the analysis of the course goals, the researcher and the instructor concluded that the basic transfer skill for this course was students' ability to extract and present the main point of a given contextual narrative. Due to the constraints of this study, the narratives used were short passages extracted from gospel texts similar to those used for the classroom assignments.

These constraints limited the choice of research design to a one-group quasi-experimental design using repeated measures.

Subgroups defined from a convenience sample based on both demographic and entry-level performance measures were used as between-groups factors.

4.2 Research Methods and Methodologies

4.2.1 Sample

The population of interest for this study was made of all students enrolled in the Introduction to the New Testament course between January and May of 2004. The research team found a large heterogeneous student body of 155 students, ranging from freshmen to seniors, and coming from 26 diverse majors. This is a typical population for a survey class that approaches a topic of general interest and targets a large spectrum of students. A convenience sample based on voluntary participation was chosen for inclusion in the study. Participants were given the possibility to obtain extra points for the completion of each of the associated tasks as an incentive to participate in this study.

This resulted in a sample size of 104 students that participated in all phases of the study and completed all required information. Of these, two cases were dropped during the data screening process, leaving 102 participants for the final analysis. On average, students participating in this DBR cycle were 19 years old, ranging from 18 to 25 years old. Most were freshmen (44%) or sophomores (33%), and a few were either juniors (7%) or seniors and higher (16%). The majority of participants (57%) were female. As for participants' majors, the 26 self-reported types were grouped in four categories: 1) humanity studies, including humanities and fine arts (18%); 2) social sciences, including education, psychology, and journalism (34%); 3) hard sciences, including natural sciences, engineering, and all business majors(34%); and 4) undecided (14%).

Generalizability of results was not a primary goal for this study. The major purpose of this cycle was to determine whether or not the implementation of the online cognitive flexibility hypertext had an impact on participants' basic skills in analyzing short contextual narratives. The effects observed in this study informed the next level of design and research conducted on a similar population.

4.2.2 Measures

Two major measures were used in this study, one for students' performance and another for their level of epistemic beliefs.

4.2.2.1 Measures of Student Performance

For the performance analysis, participants were presented with the task of writing a short essay on the main idea of a gospel narrative passage. Three equivalent short gospel passages were selected by the instructor and administered as pretest, posttest, and delayed-posttest measures (Table 4.1).

Two types of rubrics were used to score these essays. The first type was a content-oriented rubric. Two content-oriented rubrics were developed by the instructor to score student performance for pretest, posttest, and delayed-posttest essays. These rubrics used a scale from 1 = *low performance* to 6 = *high performance*, with intermediary scores at quarter-point intervals (see Appendix C). The course instructor scored all essays for content. In preparing the essays for scoring, the researcher placed them in random order and removed all identification information. This was done to avoid any bias associated with scorer's perception of student's overall classroom performance. Also, five random pretest essays were randomly placed among the posttest essays and scored by the instructor using the appropriate rubric.

Table 4.1

The Task and its Associated Short Essays Used in Measuring Students' Performance

Task	Please write 50-100 words on what you think is the main idea of the following story. I am not looking for a right or wrong answer. I just want some examples of how students interpret texts at the beginning of the course. You will receive 5 points for your efforts. Here's the story:
Pretest Essay	
Text	The land of a rich man produced abundantly. And he thought to himself, 'What should I do, for I have no place to store my crops?' Then he said, 'I will do this: I will pull down my barns and build larger ones, and there I will store all my grain and my goods. And I will say to my soul, Soul, you have ample goods laid up for many years; relax, eat, drink, be merry.' But God said to him, 'You fool! This very night your life is being demanded of you. And the things you have prepared, whose will they be?'
Posttest Essay	
Text	Now as they went on their way, he entered a certain village, where a woman named Martha welcomed him into her home. She had a sister named Mary, who sat at the Lord's feet and listened to what he was saying. But Martha was distracted by her many tasks; so she came to him and asked, "Lord, do you not care that my sister has left me to do all the work by myself? Tell her then to help me." But the Lord answered her, "Martha, Martha, you are worried and distracted by many things; there is need of only one thing. Mary has chosen the better part, which will not be taken away from her."
Delayed Posttest Essay	
Text	[Jesus] said also to the one who had invited him, 'When you give a luncheon or a dinner, do not invite your friends or your brothers or your relatives or the neighbors, in case they may invite you in return, and you would be repaid. But when you give a banquet, invite the poor, the crippled, the lame, and the blind. And you will be blessed, because they cannot repay you, for you will be repaid at the resurrection of the righteous.'

Of five random pretest essays scored, four were scored lower in the second round of scoring than the initial scores. Overall, the pretest essays when scored along with the posttest essays were on average lower ($M = 3.9$, $SD = 1.39$) than when initially scored with the other pretest essays ($M = 4.15$, $SD = 1.69$). With the limitation of a small effect size and low power, no significant difference was observed between the two sets of scores, $t(4) = .79$, $p = .47$.

The quality of argumentation rubric was the second type of scoring instrument used. One argumentation rubric was developed and applied to all essays.

The argumentation rubric used a scale from 1 = *low quality of argumentation* to 5 = *high quality of argumentation* with intermediary scores at one-quarter-point, if needed (Appendix C). Two raters, the researcher and another doctoral student in the field of learning science, scored each essay. Considering the exploratory nature of this study, any discrepancies in assigned scores between the raters were discussed and an adjudicated score was used. Regardless of the fact that none of the raters had direct contact with the student body, in order to maintain the consistency of the scoring procedure, all essays had identification data removed and were placed in random order for scoring. The final score for each essay was determined by adding the performance score and quality of argumentation score, which resulted in potential final scores ranging from 2 = *low overall performance* to 11 = *high overall performance*.

4.2.2.2 Measures of Student Epistemic Beliefs

To measure participants' epistemic beliefs, the Epistemic Beliefs Inventory (EBI) was administered to all participants (Schraw, Bendixen, & Dunkle, 2002). The EBI measures the epistemic beliefs of adults using five epistemic factors with three items each: 1) omniscient authority; 2) certain knowledge; 3) quick learning; 4) simple knowledge; and 5) innate ability.

Because the test-retest studies indicated that some factors loaded different items when the context changed (Schraw et al., 2002, p. 271), students were presented with all 29 items included in the EBI (Appendix D, Table D1). The fifteen items for the scale used in this study resulted from a principal factor extraction with five-factor restriction, followed by varimax orthogonal rotation, and promax oblique rotation to test for potential inter-factor correlations.

Factor labels, item-to-factor loadings, Eigenvalues, and values of coefficient alpha for the five factors are shown in Appendix D, Table D2. Four factors in the scale resulted from the dataset used in this study loaded at least one different item as compared to Schraw's scale. A paired-sample t test was used to compare these four factors from the new scale and from Schraw's scale. Along with the strong significant positive correlations between the four factors in the two scales, the analysis revealed a significant difference between mean levels of certain knowledge, $t(101) = 10.14$, $p < .01$, and simple knowledge, $t(101) = 3.33$, $p < .01$, in the two scales (see Appendix D, Table D3).

Considering these differences, the scale resulted for this study's dataset was used to measure students' epistemic beliefs as it better reflected the context of this study. A Likert response scale with 1 = "strongly disagree" and 5 = "strongly agree" was used for the 15 items included in this study. Because of the reversed nature of the five dimensions in the EBI scale, the epistemic beliefs (EB) scores were computed as $EB = (EBI_{\max} + EBI_{\min}) - EBI$, and ranged from 15 = *min EB* to 75 = *max EB*.

4.2.3 Design

One one-way ANOVA operations were used for this study with one repeated-measures factor and a series of four mixed-design ANOVAs with one repeated-measures factor, time, and between-groups factors. Due to the constraints on the research process, a single-group treatment was used (Trochim, 2001, p. 175). From the single-group treatment, the participants were assigned to subgroups on the basis of: a) cutoff scores on pre-program measures for entry-level knowledge (three subgroups) and epistemic beliefs (two subgroups); and b) demographic characteristics with four major subgroups, and four biblical criticism methods.

These subgroups were considered significant descriptors for the diversity of the student body engaged in this course. The subgroups were then included in the analysis as between-groups factors of the mixed-design ANOVAs.

From the pretest to the posttest, students were involved in gospel interpretation and used Cinema Hermeneutica as an integral part of the instructional activity along with lectures and small-group discussions. From the posttest to the delayed-posttest, students analyzed non-gospel texts using only lectures and small-group discussions (Figure 4.2).

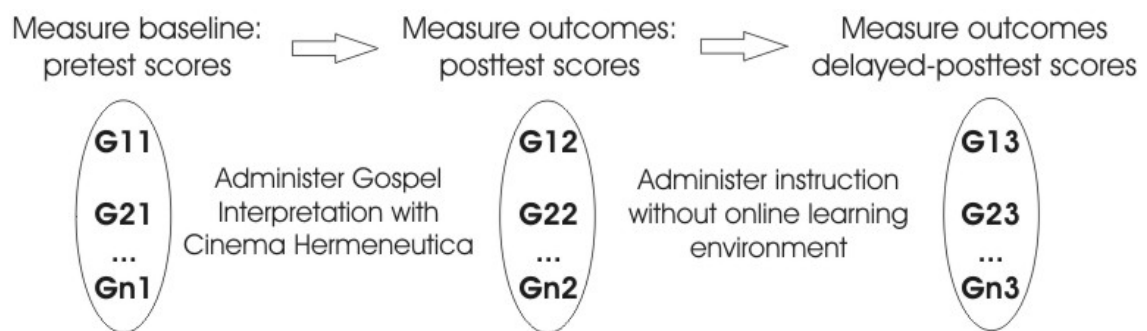


Figure 4.2 Single-group treatment design used for the first DBR cycle; Gij – the subgroups used as between-groups factors; i – the number of groups from 2 to 4; j – the measurements.

From a methodological perspective, the single-group treatment design is susceptible to several internal-validity threats. Because the between-groups subjects were asymmetrically sampled from the treatment population the *regression to the mean* is one of the most important threats for the internal validity of this study. To analyze the interaction effects, the posttest and delayed-posttest means were adjusted for each group based on the impact of the group's mean deviation from the population mean and the regression to the mean coefficient (Trochim, 2001, p. 180).

$$M_{adj} = M_{Gi} - (1 - r) * (M - M_{Gi})$$

Where:

M_{adj} = adjusted group mean for posttest and delayed-posttest respectively;

M_{Gi} = mean of group “i” at pretest and adjusted posttest respectively;

M = population mean at pretest and posttest respectively;

r = correlation between consecutive measurements.

Testing threat, another threat to internal validity for this type of design, was minimal because no feedback was provided from pretest to posttest and to the delayed-posttest respectively. The rewards (extra-points) were awarded for submitting the essay without any adjustment for the quality of the respective essay. Students were then not primed at the pretest for the nature of the learning skills targeted in the coming instructional treatments. Finally, to minimize the instrumentation threat, two measures were taken. The content and the length of the gospel excerpts for all three measures were selected by the instructor who acted as subject matter expert and also who developed the equivalent content scoring-rubrics. In addition, argumentation quality, a complementary measure less sensitive to the content, was used by the researcher in scoring all essays.

4.2.4 Procedures

The EBI questions, the pre-test essay, and the posttest essay were administered online between January and March 2004, using short surveys generated with the open-source phpESP Easy Survey Package (<http://sourceforge.net/projects/phpesp/>). The surveys were open for all students enrolled in the Introduction to New Testament course and the links to the survey page were posted in a dedicated section on the WebCT home page.

The first survey was administered online during the second week of the course, between January 26 and February 1, 2004, when Cinema Hermeneutica was introduced to the students. The survey started with an informed consent page followed by a pretest essay, EBI items, demographic data, and student identification data. After posting the link to the survey on the WebCT home page, the instructor formally informed students during lecture about the conditions of engaging in the tasks associated with this survey. The instructor also encouraged students to consider participating in this study to earn extra points.

Following the administration of the pretest survey the students fully engaged in the gospel interpretation segment of the course that covered the pretest – posttest part of this research study. For this segment of the course, students were exposed to both face-to-face and online instructional tasks. The face-to-face tasks included lectures and small-group discussions while the online tasks individually engaged students in the inquiry structures of the four biblical criticism methods through the use of Cinema Hermeneutica.

After engaging in using Cinema Hermeneutica, all participants spent the first week of their online activity to review the four perspectives as part of their simulated part-time job training. Once trained, students had the opportunity to choose one of the methods based on the availability of that method. To ensure a uniform distribution of students across the four methods, only a certain number of participants could select a given method. The allocation of methods was done on a first-come-first-serve basis. Once a method was chosen, each student engaged in the tasks of that method starting with the non-gospel worked example, followed by the non-gospel analysis of a self-selected movie.

In the last step in the online activity, participants assumed the role of a critic for a religious magazine, a full-time job that required them to practice and refine their method-related analysis skills in the context of short texts from various gospels. As their culminating activity in Cinema Hermeneutica, participants submitted a formal long essay on a given gospel text using the method they practiced in the previous instructional tasks. A formal in-class examination that included the interpretation of a gospel text along with other assessment items derived from the lectures and small-groups tasks concluded the gospel segment of the course.

The second survey was administered between February 25 and March 3, 2004. It contained the posttest essay and student identification data. The procedure associated with the administration of this second survey was similar with the one used for the pretest survey.

Following the gospel segment, students were involved in two course segments (letters to Paul and Historical Jesus) that focused on non-gospel biblical texts. These two course segments covered the posttest to delayed-posttest part of this research study. For these two segments, participants were exposed only to face-to-face instructional tasks that included lectures and small-group discussions. The delayed posttest essay was administered on paper on May 11, 2004 as part of the final exam of the course. To maintain the same type of incentive as with the previous essays, the posttest essay was optional and rewarded with extra-credit points for the final exam. The essays were collected in hard-copies from students' test-booklets. A neutral identification number was assigned to each essay and they were then scored in a random order for both the content and argument quality.

4.2.5 Data Analysis

4.2.5.1 Dependent and Independent Variables

To facilitate the analysis of variance from pretest to posttest and to delayed-posttest, the total essay scores for all three measures were computed by adding the content scores and argument quality scores. The dependent variables were the pretest score, the posttest score and the delayed-posttest score.

Four independent variables serving as descriptors of the diversity of the student body and resulted from grouping the participants on the basis of four pre-program measures that were used in this DBR research macro-cycle. The first independent variable, the major group, had four conditions that resulted from grouping students, based on their self-reported major: a) humanities ($n = 18$); b) social sciences ($n = 35$); c) hard sciences ($n = 35$); and d) undecided ($n = 14$). Details regarding the composition of these four groups are presented in Appendix E. Levene's test showed that the error variance was equal across groups for the pretest, $F(3, 98) = 1.29$, $p = .28$, posttest, $F(3, 98) = 1.40$, $p = .25$, and delayed-posttest measures, $F(3, 98) = .57$, $p = .63$.

The second independent variable, the method used in the online environment, resulted from participants' constrained self-selection of one of the following methods simulated in the virtual activity: a) narrative criticism (43 participants); b) feminist interpretation (17 participants); c) redaction criticism (23 participants); and d) historical criticism (19 participants). Levene's test showed that the error variance was equal across groups for the pretest, $F(3, 98) = .85$, $p = .47$; and posttest, $F(3, 98) = 1.18$, $p = .32$.

The equality of variances was not supported for the delayed-posttest scores, $F(3, 98) = 3.38, p < .05$. To avoid the inflation of type I errors, a more restrictive $p = .025$ was used to report significant between-subjects contrasts.

The third independent variable, epistemic beliefs (EB), was a between-groups factor with two conditions derived from the EBI total score as a split to the mean: low ($EB \leq 43$) and high ($EB > 43$). This cutoff point followed the conditions reported in previous studies on the impact of epistemic beliefs on students' use of cognitive flexibility hypertexts (Jacobson et al., 1996; Jang, 2000). Levene's test showed that the error variance was equal across groups for the pretest, $F(1, 100) = 2.02, p = .16$; posttest, $F(1, 100) = .49, p = .48$; and delayed-posttest, $F(1, 100) = .13, p = .72$.

Finally, the fourth independent variable, entry-level knowledge, was a between-groups factor with three conditions derived from the pretest scores: a) low ($pretest \leq 5$), b) medium ($5 < pretest < 7$), and c) high ($pretest \geq 7$). These three groups resembled the typical approach of undergraduate instructional programs that target an average knowledge level with a focus on helping low- and medium-entry level knowledge groups to exceed the target level while keeping the high-entry level knowledge group on a growing trend. Because the mean and median of the pretest scores were equal, the cutoff points were set on \pm one-half standard deviation from the mean of pretest scores to generate groups of balanced size. Levene's test showed that the error variance was equal across groups for the posttest, $F(2, 99) = .35, p = .71$, and delayed-posttest, $F(2, 99) = .10, p = .90$. The equality of variances was not supported for pretest scores, $F(2, 99) = 3.49, p < .05$. To avoid the inflation of type I errors, a more restrictive $p = .025$ was used to report significant between-subjects contrasts.

The analysis was performed using the GLM repeated measures procedure in SPSS.

4.2.5.2 Research assumptions

Independence of observations was assumed, meaning that participants' response to the posttest and delayed posttest essays were not influenced by their answers to the pretest and posttest essays respectively.

4.2.5.3 Data Preparation and Screening

Before beginning the data screening process, a systematic process of preparing the data was followed. First, the content scores and the argument quality scores for pretest, posttest, and delayed posttest essays were placed in a single SPSS file, along with the EBI items and demographic data. Second, the content scores and the argument quality scores were summed for each participant and placed in new variables for the total pretest, posttest, and delayed-posttest scores. Third, the negatively keyed items in the EBI scale were recoded to match the rest of the items in the scale. There were two such items: one in the omniscient authority factor and another one in the certain knowledge factor. Fourth, the 15 items that significantly loaded in the EBI scale were summed to obtain the EBI total score. Finally, two new categorical variables were created: one for entry-level knowledge (low, medium, and high) and another one for epistemic belief level (low and high) using the cutoff point for the pretest scores and for EBI scores respectively.

The data screening was also a multi-step process. First, SPSS's descriptive statistics command was used to examine whether all continuous variables were within plausible ranges and that all means and standard deviations were plausible, given the dataset. Second, the data were screened for univariate outliers.

During the data screening process, out of the 104 cases, one case was identified as a univariate outlier and was dropped from the analysis. Finally, after dropping the univariate outlier, the analysis of multivariate outliers using Mahalanobis distance (Tabachnick & Fidell, 2001, p. 93) indicated one multivariate outlier ($\text{Chi Square}_{\max} = 56.27 < 32.91 = \text{Critical Value of Chi Square}$), leaving 102 cases for the final analysis.

4.2.5.4 Normality

Normality was verified for the three dependent variables: pretest scores, posttest scores, and delayed posttest scores. The analysis of the skewness and kurtosis for the three continuous variables provided a first rough estimate that sustained the normality of this dataset (see Table 4.2).

Table 4.2

Descriptive Statistics for the Continuous Variables

	N	Mean	SD	Skewness	Kurtosis
Pretest scores	102	6.0	1.75	.16	-.72
Posttest scores	102	6.56	1.63	.04	-.22
Delayed posttest scores	102	7.05	1.99	.10	-.83

A Kolmogorov-Smirnov Test for pretest scores ($K-S Z = .80, p > .5$), posttest scores ($K-S Z = .72, p > .7$), and delayed-posttest scores ($K-S Z = .84, p > .5$) indicated that normality is a robust assumption for this data set. In addition, the Q-Q plots for the three continuous variables strengthened the assumption of normality for this data set by showing a uniform distribution of the observed values along the normal regression line, with deviations from normal ranging from (- .8) to (+ .6) quartiles. Figure 4.3 exemplifies the Q-Q Plot and the deviation from normal distribution for pretest scores.

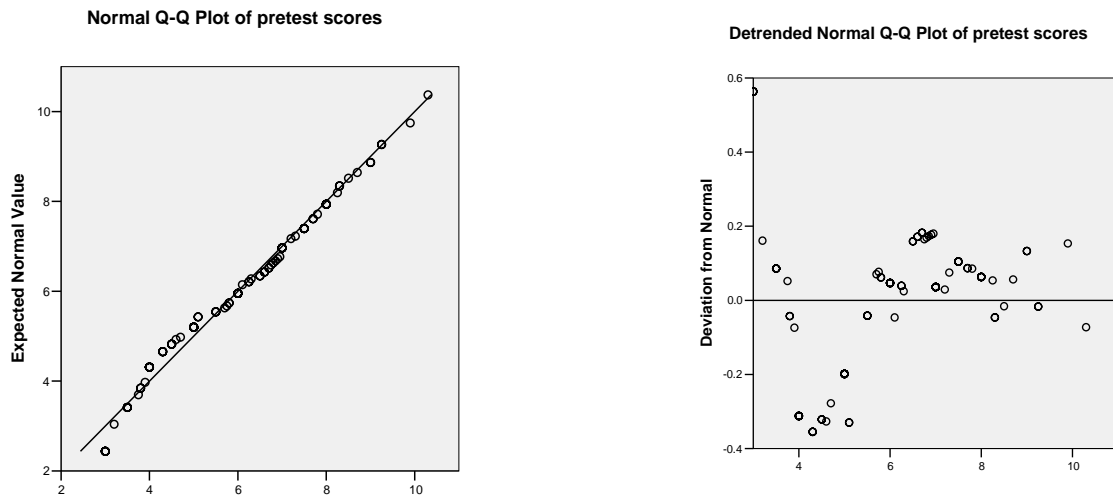


Figure 4.3 Q-Q Plot of pretest scores.

4.2.5.5 Homogeneity of Covariance

Box's tests of equality of covariance matrices were found to be insignificant for:

a) entry-level knowledge, Box's $M = 17.50$, $F(12, 45883) = 1.39$, $p = .16$; b) major, Box's $M = 16.56$, $F(18, 11901) = .86$, $p = .63$; c) epistemic beliefs, Box's $M = 1.55$, $F(6, 71228) = .25$, $p = .96$; and d) method, Box's $M = 22.08$, $F(18, 16679) = 1.15$, $p = .30$.

This showed that the observed covariance matrices of the dependent variables were equal across groups for all four mixed-design ANOVAs in this study.

4.3 Results and Interpretation

4.3.1 Overview

The driving question of this study was whether the inclusion of an online cognitive flexibility hypertext in the instructional program would have a positive impact on students' ability to transfer contextual meaning-making skills to identification of the main point of gospel texts. A one-way ANOVA with one repeated-measures factor, time, was performed (Table 4.3).

Table 4.3

*ANOVA Summary Table for Study Of Time/Treatment Using a Repeated-Measures**Design*

Source	<i>df</i>	F	η^2	Observed Power
Between subjects				
Error	101	(1.32)		
Within subjects				
Time	2	9.95**	.09	.98
Error	202	(2.86)		

Notes: Values enclosed in parentheses represent mean square errors; N = 102;

** $p < .001$

The research questions associated with student body diversity were if this impact of including an online cognitive flexibility hypertext in the instructional program varied across: a) entry-levels knowledge; b) epistemic beliefs levels; c) majors; and d) methods used in the online learning environment. The results of the four mixed-design ANOVAs with repeated-measures and between-groups factors associated with these research questions were summarized in Table 4.4.

4.3.2 Time Effect

The tests of within-subjects effects indicated a significant effect for time, $F(2, 202) = 9.95$, $p < .001$. Within-subjects contrasts showed that the *pretest* scores were significantly lower than the *posttest* scores, $F(1, 101) = 6.44$, $p < .05$, and the *delayed-posttest* scores, $F(1, 101) = 18.00$, $p < .05$.

The multivariate effect of time was also significant, Wilks' lambda = .85, $F(2, 100) = 9.04$, $p < .001$.

Contrasts of the mean differences using Bonferroni adjustment for multiple comparisons showed that: a) the mean score gains from pretest to posttest and from pretest to delayed-posttest respectively *were statistically significant* ($p < .05$); and b) the mean score gain from posttest to delayed-posttest was not statistically significant ($p = .13$).

Table 4.4

Overview of the Four Mixed-Methods ANOVAs With Repeated Measures

Source	<i>df</i>	F	η^2	Observed Power
Between subjects				
Major category (A)	3	.57	.02	.16
Error	98	(1.32)		
Method used online (B)	3	6.90**	.17	.97
Error	98	(1.28)		
Epistemic beliefs level (C)	1	3.04	.03	.41
Error	100	(1.32)		
Entry-level knowledge (D)	2	106.22**	.68	.99
Error	99	(.99)		
Within subjects				
Time (E)	2	9.95**	.09	.98
E x A	6	3.24*	.09	.98
Error (time)	196	(2.67)		
E x B	6	1.01	.03	.39
Error (time)	196	(2.91)		
E x C	2	.39	.00	.11
Error (time)	200	(2.89)		
E x D	3.38 ^a	1.11	.02	.32
Error (time)	167 ^a	(2.47)		

Notes: Values enclosed in parentheses represent mean square errors; ^a the degree of freedom for within subjects effects adjusted with Greenhouse-Geisser correction factor;

* $p < .01$; ** $p < .001$

4.3.3 The Impact of Students' Major

4.3.3.1 Test of the interaction term (Time x Major)

After correcting for the regression to the mean for the four Major groups, the test of within-subjects effects for the interaction term (Time x Major) was found to be statistically significant, $F(6, 196) = 3.24, p < .01$. The multivariate test for the interaction was also significant, Wilks' lambda = .84, $F(6, 194) = 2.94, p < .001$. Figure 4.4 shows the estimated marginal means for the four groups.

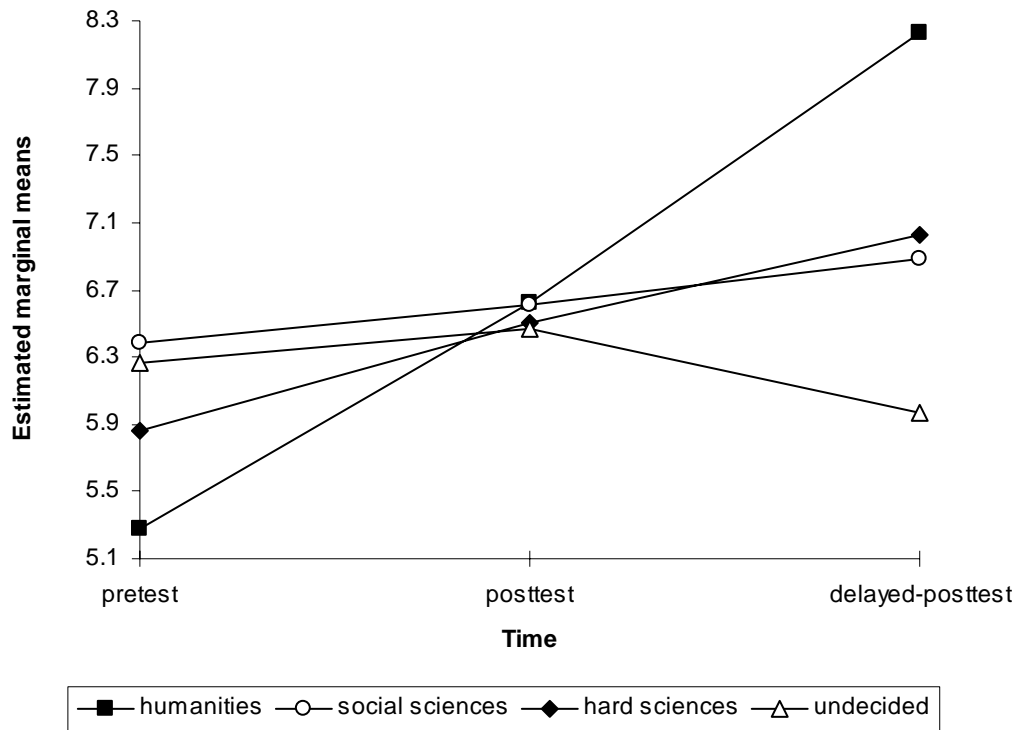


Figure 4.4 The interaction between Major x Time

4.3.3.2 Tests for simple effects

The tests of simple effects of time for each Major group showed *statistically significant* differences of the mean test scores across time for the humanities group, Wilks' lambda = .78, $F(2, 97) = 14.09$, $p < .05$, and for the hard sciences group respectively, Wilks' lambda = .92, $F(2, 97) = 4.47$, $p < .05$. Contrasts of mean differences using Bonferroni adjustment for multiple comparisons indicated that: a) the mean score gain was significant for the humanities group from *pretest to posttest* ($p < .05$), but did not indicate significance for the hard sciences group ($p = .24$); and b) the mean score gain was significant for the humanities group from *posttest to delayed-posttest* ($p < .05$), but no significance was found for the hard sciences group ($p = .60$).

However, *no significant* simple effects were found for the social sciences group, Wilks' lambda = .98, $F(2, 97) = .79$, $p = .46$, or for the undecided group, Wilks' lambda = .99, $F(2, 97) = .29$, $p = .75$. Even if statistically insignificant, it is interesting to mention the decreasing slope of mean scores for the undecided group from the posttest to delayed-posttest when the online learning environment was not used (see Figure 4.4).

4.3.4 The Impact of the Gospel Interpretation Method used online

4.3.4.1 Test of the interaction term (Time x Method)

After correcting for the regression to the mean for the four Method groups, the interaction Method x Time *failed to show statistical significance*, $F(6, 196) = 1.01$, $p = .42$. The multivariate test for the interaction was also *not significant*, Wilks' lambda = .94, $F(6, 194) = .94$, $p = .47$. Figure 4.5 shows the estimated marginal means for the four groups.

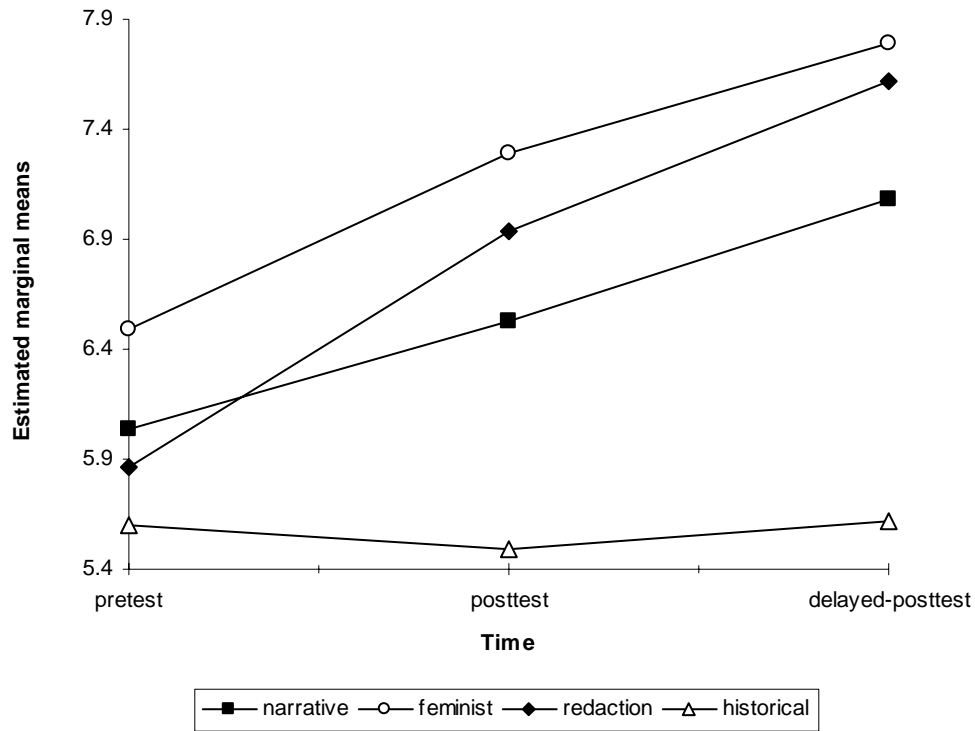


Figure 4.5 The interaction between time and method used in Cinema Hermeneutica

Regardless of the fact that the interaction between time and method was insignificant, because this study was exploratory in nature, an interpretation of main effects is in order and is presented in the following section (Hatcher & Stepanski, 1994, pp. 354-355).

4.3.4.2 Tests of the main effect for Time

The within-subjects test for the Time effect was statistically significant, $F(2, 194) = 8.16, p < .001$. The multivariate test for the Time effect was also statistically significant, Wilks' lambda = .87, $F(2, 97) = 7.43, p < .001$. Contrasts of the mean differences using Bonferroni adjustments for multiple comparisons showed that: a) the mean score gains from pretest to delayed-posttest was *statistically significant* ($p < .05$); and b) the mean score gain from pretest to posttest ($p = .06$) and from posttest to delayed-posttest ($p = .23$) *failed to show significance*.

4.3.4.3 Tests of the main effect for Method

Tests of between-subjects effects for Method showed statistical significance, $F(3, 98) = 6.90, p < .001$. Post hoc Bonferroni tests showed that students in the historical criticism group scored significantly lower than students in: a) the redaction criticism group ($p < .01$); b) the feminist interpretation group ($p < .01$); and c) the narrative group ($p < .025$).

4.3.5 The Impact of Students' Epistemic Beliefs level

4.3.5.1 Test of the interaction term (Time x Epistemic Beliefs level)

No statistical significance was found for the interaction of Time x Epistemic beliefs after correcting for the regression to the mean for the two epistemic beliefs groups, $F(2, 200) = .39, p = .68$. The multivariate test for the interaction was also *not significant*, Wilks' lambda = .99, $F(2, 99) = .35, p = .71$. Figure 4.6 shows the estimated marginal means for the two epistemic beliefs groups.

4.3.5.2 Tests of the main effect for Time

The within-subjects test for the Time effect was statistically significant, $F(2, 200) = 9.72, p < .001$. The multivariate test for the Time effect was also statistically significant, Wilks' lambda = .85, $F(2, 99) = 8.83, p < .001$. Contrasts of the mean differences using Bonferroni adjustments for multiple comparisons showed that: a) the mean score gains from pretest to posttest ($p < .05$) and from pretest to delayed-posttest ($p < .001$) were *statistically significant*; and b) the mean score gain from posttest to delayed-posttest ($p = .13$) *failed to show significance*.

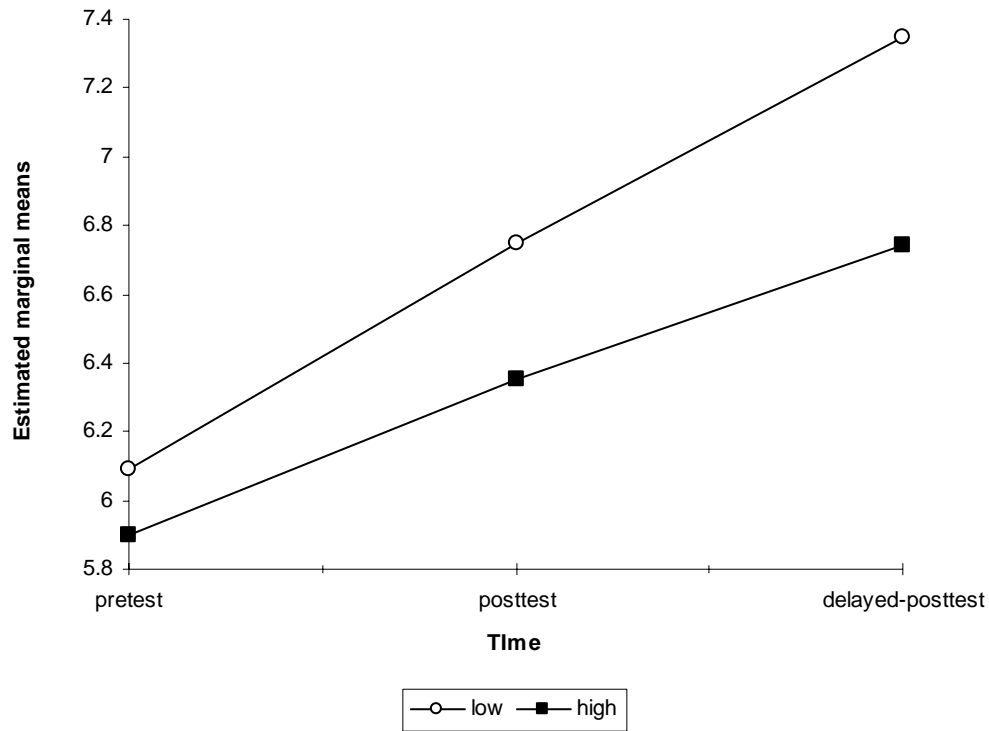


Figure 4.6 The interaction between time and epistemic beliefs.

4.3.5.3 Tests of the main effect for Epistemic Beliefs

Tests of between-subjects effects for Epistemic Beliefs failed to show statistical significance, $F(1, 100) = 3.04, p = .08$.

4.3.6 The Impact of Students' Entry-level Knowledge

Because the assumption of sphericity could not be assumed, Mauchly's $W = .82$, Chi-square $(2, N = 102) = 19.8, p < .05$, the Greenhouse-Geisser adjustment for degrees of freedom was used in reporting the significance of the F test for within-subjects effects (Hatcher & Stepanski, 1994, p. 326).

4.3.6.1 Test of the interaction term (Time x Entry-level Knowledge)

After correcting for the regression to the mean for the three entry-level knowledge groups, the interaction of Time x Entry-level failed to show statistical significance, $F(3.38, 167) = 1.11, p = .35$.

The multivariate test for the interaction was also *not significant*, Wilks' lambda = .93, $F(4, 196) = 1.70$, $p = .15$. Figure 4.7 shows the estimated marginal means for the three entry-level groups.

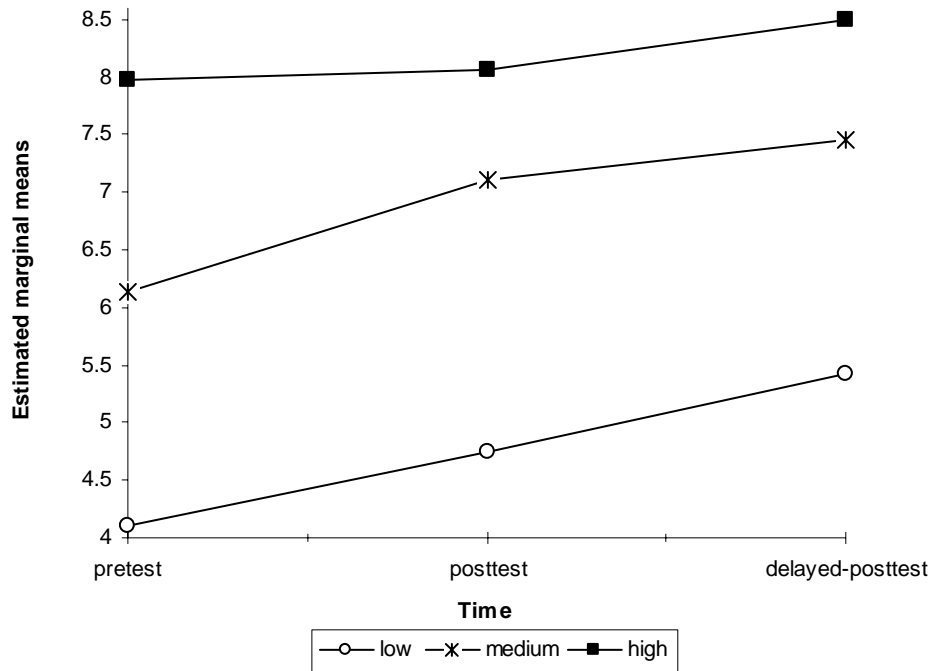


Figure 4.7 The interaction between time and entry-level knowledge.

4.3.6.2 Tests of the main effect for Time

The within-subjects test for the Time effect was statistically significant, $F(1.69, 167) = 13.38$, $p < .001$. The multivariate test for the Time effect was also statistically significant, Wilks' lambda = .74, $F(2, 98) = 17.36$, $p < .001$. Contrasts of mean differences using Bonferroni adjustments for multiple comparisons showed that: a) the mean score gains from pretest to posttest ($p < .01$) and from pretest to delayed-posttest ($p < .001$) were *statistically significant*; and b) the mean score gain from posttest to delayed-posttest ($p = .15$) *failed to show significance*.

4.3.6.3 Tests of the main effect for Entry-level Knowledge

Tests of between-subjects effects for Entry-level Knowledge showed statistical significance, $F(2, 99) = 116.20, p < .001$. Post hoc Bonferroni test showed that students in the three entry-level knowledge groups were not grouped. That is, students in the high entry-level group scored significantly higher than those in the medium and low entry-level groups ($p < .001$), and students in the medium entry-level group scored significantly higher than those in the low entry-level knowledge group ($p < .001$).

4.4 Conclusions

The overall analysis showed a positive answer to the first research question. That is, the main effect indicated a *significant increase* of the mean essay scores for the first instructional segment, from pretest to posttest, when Cinema Hermeneutica was part of the instructional process. On the other hand, the second instructional segment that included only lectures and small-group discussions, from posttest to delayed-posttest, *failed* to show a significant increase of mean essay scores.

The positive impact of the first instructional segment is strengthened when considering that the time span between posttest and delayed-posttest was twice that of the one between the pretest and posttest. Due to the time factor, the slope of the mean gains when Cinema Hermeneutica was used is higher than the slope of mean gains for the overall instructional process (Figure 4.8).

For the second research question, that is, the impact of the simulated method in Cinema Hermeneutica, analysis of results indicated a statistically significant between-subjects effect for Method at posttest and delayed-posttest.

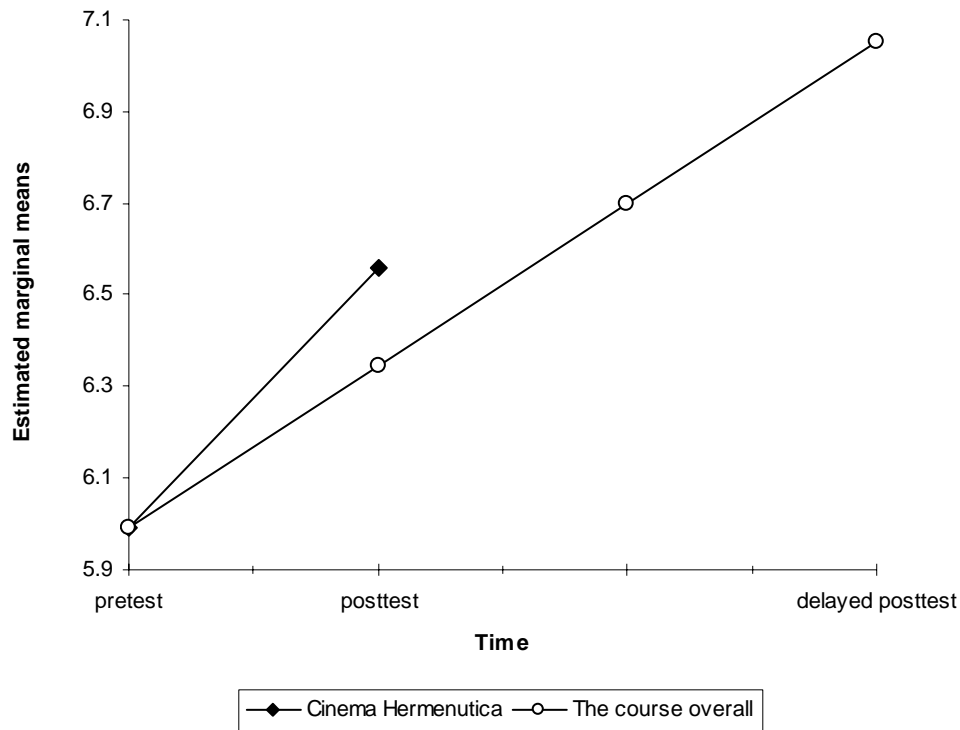


Figure 4.8 The slope of gains for pretest to posttest and for the entire instructional process respectively.

Students started with comparative entry-score means, and, after engaging in the instructional process formed: a) a low-outcome group made of historical criticism students; and b) a high-outcome group made of narrative criticism, redaction criticism, and feminist interpretation students. Students in the historical criticism group scored significantly lower than those in any of the three components of the second group (see Figure 4.5). This result suggests that, at least from the perspective of students' text interpretation skills, the structure of the activity for the historical criticism method was less effective than the structure of activities for the other three methods.

The third research question analyzed the impact of three quantifiers of students' diversity. Of these, Major showed a significant interaction in time.

Two important outcomes emerged from this interaction. First, the instructional segment that included Cinema Hermeneutica brought students from all majors to similar posttest score means, $F(3,98) = 1.69$, $p = .17$, while the remaining instructional segment produced a significant between-groups difference, $F(3,98) = 3.42$, $p < .05$ (see also Figure 4.4). This finding supports the ability of the Cinema Hermeneutica online learning environment to compensate for the diversity of needs of students coming from different majors, that is, the needs that relate to the interpretation skills of short narratives.

Second, the groups that significantly benefited of the overall instructional program were the humanities and the hard sciences groups. However, of these two Major groups, only the humanities group showed a significant increase in mean scores both in the instructional segment that included Cinema Hermeneutica and in the one that followed it. This last finding is not surprising considering the fact that the topic of the course was part of the humanities field and thus directly addressed instructional needs of this group. Another interesting finding was the change in the mean-scores gains for the students in the undecided major group from a slightly positive slope for the first instructional segment when Cinema Hermeneutica was used to a negative slope for the second instructional segment. This negative slope of mean scores indicates that the undecided group scored significantly lower on the delayed-posttest than any of the other groups. This finding also suggests a positive impact due to the inclusion of the online learning environment in the instructional program. One possible explanation for this positive impact could be the ability of the online learning environment to offer individual guidance and focus.

Individual guidance and focus therefore proved to be important factors for this group as its members had a mean age of 18.7 years old, and most of them (79%) were freshmen, $\chi^2(6, N=102) = 13.76, p < .05$.

Epistemic beliefs and entry-level scores, the other two quantifiers of students' diversity, did not produce any interaction in time. However, the behavior of the two diversity measures was not the same across time. The low and high epistemic beliefs (EB) groups followed a similar between-groups pattern across time, with the low EB group scoring constantly higher than the high EB group as measured by their mean-scores at pretest, posttest and delayed-posttest.

As for the entry-level skills groups, even if the low, medium, and high mean entry-level score groups kept the same relative position from the pretest to the delayed-posttest, the behaviors in time of the three groups were different. That is, the medium entry-level skills group was the only one for which the mean scores increased significantly both when Cinema Hermeneutica was part of the instructional process and also for the instructional process overall. The low entry-level skills group also followed an increasing trend, but the mean scores increased significantly only for the overall instructional process. Finally, the high entry-level skills group maintained the same mean scores for the overall instructional process with a slight negative slope for the first segment when Cinema Hermeneutica was part of the instructional process. The fact that the instructional segment that included Cinema Hermeneutica primarily targeted the medium entry-level skills group signaled the potential for future improvement of the environment to better address the needs of students with both high and low entry-level skills who enroll in this course.

CHAPTER 5

THE SECOND DESIGN-BASED RESEARCH MACRO-CYCLE:

REVISED LEARNING AND RESEARCH TRAJECTORIES

During the first macro-cycle, the Design-Based Research (DBR) team developed and implemented an online learning environment as part of the Introduction to the New Testament course. As shown in Figure 5.1 the first macro-cycle was a two-stage process: 1) the theory-driven design stage that proposed the use of a cognitive flexibility hypertext (CFH), Cinema Hermeneutica; and 2) the empirical refinement that focused on the ability of the instructional segment that included the online learning environment to support the transfer of skills for contextual text interpretation.

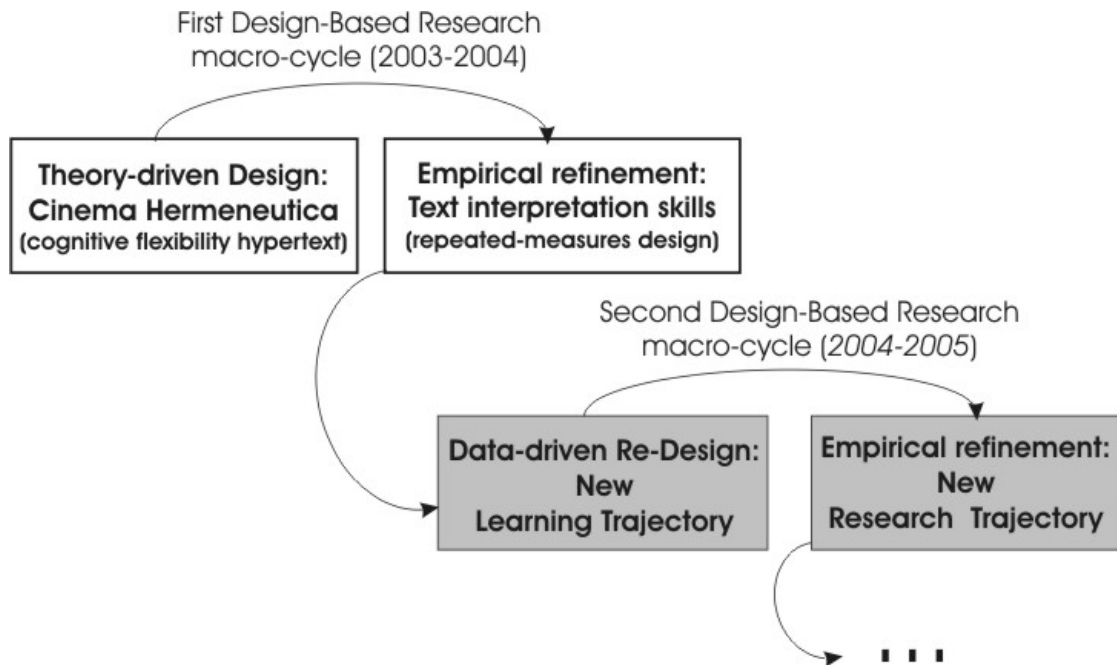


Figure 5.1 The second macro-cycle for the Introduction to the New Testament course

No partial refinements of the design, known as micro-cycles (e.g. Cobb, 2001; Jonassen et al., 2007), were implemented during the first macro-cycle due to two major constraints.

First, Cinema Hermeneutica was part of an ongoing learning process that evolved throughout the Gospel segment of the course. Second, the online learning environment was introduced as a scaffold for virtual learning tasks intended to complement face-to-face lectures and small-group discussions. The first macro-cycle then provided empirical data that served as input for the redesign stage of this second DBR macro-cycle. This chapter describes the basic steps of incorporating empirical data from the first DBR macro-cycle into the design stage of the second DBR macro-cycle. These steps are highlighted in Figure 5.1.

5.1 Revised Learning Trajectory: The Daily Intelligencer

5.1.1 Assumptions and Biases

The conceptual framework of Design Based Research (DBR) assumes that the researcher is him or herself a research tool that provides reflective retrospections on the DBR process (Barab & Squire, 2004; Cobb et al., 2003; Design-Based Research Collective, 2003). This aspect is especially important when the researcher attempts to minimize the conflict between exogenous and endogenous types of design (e.g. Tabak, 2004). That is, in the design/redesign stages of each DBR macro-cycle, the DB researcher needs to balance the deterministic tendency of exogenous design grounded in formal instructional design practice and the systemic and fluid requirements of endogenous design grounded in the practice of the classroom. A common trait of both design frameworks is the DB researcher's desire to find ways to incorporate research tools into any new design that will allow for collection of empirical data to help refine future designs.

The DB researcher must assume the interrelated roles of educational researcher, instructional designer, and instructor to be able to balance the requirements and the constraints of each of these areas. The ability to effectively assume these roles is especially critical in the redesign stages of DBR macro-cycles.

As I assumed the role of the DB researcher for this study, I brought a set of knowledge and skills related to instruction, design, and research to the process that had both strengths and weaknesses for supporting the DBR process. Regarding strengths, my teaching, design, and research experience as a faculty member provided a strong foundation for my growth as instructional designer and educational researcher during my doctoral program in the Learning Sciences. For example, at the time of this study I had gained significant experience teaching face-to-face university-level courses and some experience co-teaching and independent teaching web-enhanced and fully online courses. As an adult learner during my doctoral program I was exposed to a variety of technology-enhanced courses which provided me opportunity to reflect as a learner on the advantages and disadvantages of various strategies for integrating technology into the classroom environment. I was also involved in major system development projects and small team-based research projects. Most of these activities concluded with research papers that I co-authored with both faculty and fellow doctoral students. These cumulative experiences helped me find bridges between the roles of the researcher, designer, and instructor as required by the evolution of the DBR process.

Regarding weaknesses, two major factors may have biased my actions during this DBR process.

First, most of my experience was in the field of hard and social sciences which may have biased my understanding of the needs and requirements of an instructional program in the field of humanities. Second, as both a researcher and an instructional designer, I worked with small, relatively homogeneous groups of participants. This may have influenced my perception of the needs of the large, heterogeneous group involved in this DBR process.

To maximize strengths and minimize biases associated with my involvement in the redesign stage of the DBR process, I followed two major strategies for ensuring credibility (the parallel to post-positivist researchers' notion of internal validity): peer debriefing and triangulation (e.g. Lincoln & Guba, 1985). Peer debriefing for the research results from the previous DBR macro-cycle was attended to via conversations with my committee chair, committee members and fellow doctoral students. One of the graduate students engaged in this process at that time was pursuing graduate degrees in both the Learning Science and Humanities, which helped provide a degree of neutrality to a perspective that might otherwise have been biased.

In order to ensure the traditional notion of validity, I relied on use of more than one data source to support the redesign process. In addition to my notes from group and individual meetings with the subject matter experts, an interview with the instructor and discussion board communications of the redesign team were used. The discussion board postings in Blackboard associated with the redesign stage provided perspectives from different stakeholders in the design process which were complementary to those of instructors and researchers. The ability to access the WebCT course management software used for the class also made it possible for me to review the artifacts produced by students as part of their online activity using Cinema Hermeneutica.

5.1.2 Design Conclusions from the First DBR Macro-Cycle

The empirical data from the first DBR macro-cycle indicated the need to redesign two major areas: 1) the consistency of metaphors; and 2) the match between the structure of the instructional task and students' entry-level skills.

First, the consistency of both the task structure and activity metaphors across the four biblical criticism methods was in need of improvement. The results obtained from evaluating the transfer of short-narratives implementation skills across methods showed that the historical criticism group scored significantly lower than the groups that used the other three biblical criticism methods. This result matched the instructor's feedback based on his interaction with the students, especially during small-group activities. The problems faced by the historical criticism group were unexpected considering that when students were given the opportunity to choose a virtual job associated with one of the four methods, the historical criticism method was the first to have all openings filled. As for the consistency of the metaphors across methods, the instructor reported a poor match between the virtual jobs task metaphors and the contextual metaphor of a cinema.

Second, the match between the instructional task structure and the students' entry-level skills associated with their interpretations of short narrative texts needed to be improved across all four methods. Students with low-entry level skills could benefit from more support in the online learning tasks, while high-entry level skills students could benefit from more challenging tasks during the same instructional segment.

The consistency of metaphors and the alignment of the instructional task structure with the students' entry-level skills were the main areas of improvement that served as base for the empirical-driven redesign stage of the online learning environment during the fall of 2004.

5.1.3 Changing Metaphors: from Cinema Hermeneutica to The Daily Intelligencer

To build on the empirical evidence from the first macro-cycle for the redesign process, eight graduate students from a biblical criticism course joined the design-based research (DBR) team during the fall semester of 2004. This was a win-win strategy from both instructional and design perspectives. On the one hand, this was an authentic learning experience for the eight graduate students, and it provided them with the opportunity to reflect on the topic of the course as they discussed various strategies to build effective scaffolds for supporting novice learners' understanding of biblical criticism. On the other hand, for me as both researcher and designer, the graduate students' perspectives served as a powerful mediator between instructor expertise and the expectations and struggles of the students engaged in learning biblical criticism methods. Of the eight graduate students that engaged in this stage of the redesign, two served as teaching assistants when Cinema Hermeneutica was implemented, one pursued degrees in both instructional technologies and in religious studies field, and one had a major outside the field of religious studies.

During the last half-hour of each week's class throughout the entire semester I joined the class and switched between the roles of observer and of co-moderator along with the course instructor.

In addition to the weekly face-to-face meetings, two asynchronous Blackboard forums were set up for this activity. All participants had full online access to the previous learning environment designs.

During the first meetings I introduced the group to the results of the first macro-cycle of empirical research, while the instructor and his two teaching assistants shared their insights from the previous implementation of the environment. The bulk of the remaining activities of the DBR team alternated between debating options for activity and task metaphors and refinement of the instructional tasks associated with them.

The nature of the metaphors used to simulate the learning activities in the online environment has a significant impact on both the structure of instructional tasks and on the consistency of these tasks across methods. Once the importance of this issue was discussed and accepted, the DBR group engaged in a brainstorming activity to find better metaphors for the overall activity simulated in the online learning environment. The brainstorming session started as a face-to-face meeting and continued within a dedicated online forum on Blackboard. From a design perspective, the main issue in choosing the main metaphor was the tradeoff between a) the consistent use of one metaphor for both the activity itself and the instructional tasks associated with the four criticism methods, which can limit the potential for future expansion of the environment to other methods; and b) the use of a layered set of metaphors which provides more flexibility for future expansions of the environment to other biblical criticism methods. Camp Hermeneutica offered a model that was closer to being ready for future extensions but lacked consistency across various metaphors used.

In contrast, Cinema Hermeneutica represented the first step toward consistency through the introduction of a single task-related metaphor, the part-time virtual job; however, its match with the activity metaphor was less than ideal.

The result of DBR team's first attempt to address this tradeoff was *Metrotext*, the metaphor of a city where learners could hunt for different virtual jobs that simulated various biblical criticism methods. Metrotext tried to enhance the issue of metaphor consistency without losing the potential for future design expansions that go beyond the four biblical criticism methods already used in both Camp Hermeneutica and Cinema Hermeneutica. A forum was set up in Blackboard to discuss the strength and weaknesses of the following proposed strategies for defining the structure of instructional tasks: a) redesign Camp Hermeneutica; b) redesign Cinema Hermeneutica; or c) design an entire new instructional structure for Metrotext. After considering the advantages and disadvantages of each of these strategies, the DBR group chose the last option, that is, to design a new structure of learning tasks that utilizes the context of a city as its main metaphor.

Having decided to use the city in Metrotext as the overarching metaphor for the environment, the group moved to the next redesign stage, the analysis of the nature and structure of the four activities that would engage students in the four biblical criticism methods. Because empirical results indicated a need for more consistent learning tasks across the four methods, the first step was to identify the basic principles to apply to the redesign process across all tasks. Two major recommendations emerged from the group discussions regarding a first dimension in the redesign of the instructional tasks.

The first one was to have two levels of students' engagement for each method. The second recommendation was to scaffold the two levels of engagement from simple to complex.

In the previous learning environments, learning tasks were built around two contextual settings: one based on non-gospel artifacts, the other on gospel texts. Based on student feedback both the instructor and the two teaching assistants considered this transition between contexts as being helpful for the learning process. The two contextual settings were then retained as the second dimension in each method's instructional tasks structure redesign. Combined, these two dimensions generated four potential levels in the structure of the learning tasks for each method. However, the last level of the learning tasks was already defined by the instructor as a comprehensive essay serving as one of the major course assignments. Therefore, the environment only had to fully scaffold the first three levels of engagement for each method—two for the non-gospel tasks and one for the gospel task. The scaffolding for the final level, the comprehensive gospel essay, took place through both face-to-face activities and WebCT activities.

The ever-increasing complexity throughout the learning tasks served both research recommendations from the first macro-cycle. On the one hand, it provided more structured guidance for low entry-level skills students, with a clear emphasis on the basic text interpretation skills in the first stage of the learning tasks. On the other hand, this structuring allowed for the inclusion of more complex scaffolds in the final stages of the learning tasks to address the needs of high entry-level skill students. To further address the need for deeper learning, especially for high achievers, I suggested a final online task in which students write a reflection essay on their progress throughout the online activity.

To avoid overloading the students, the reflection essay was set up as an optional task that was rewarded with extra points. With this structure in mind, the group started to redesign the learning activities associated with each method. After several rounds of discussions, the virtual jobs that students could assume in Metrotext were defined as a) a movie reviewer for narrative criticism, b) an editorial writer at a newspaper for feminist interpretation, c) a private investigator for historical criticism, and d) a music commentator for redaction criticism.

As the redesign process evolved it became clear to me that Metrotext was reintroducing the problems of the multi-layered metaphorical structure of Camp Hermeneutica, the initial design of the learning environment. The city metaphor made it quite difficult to ensure consistency in the nature of learning activities and students' tasks across the four biblical criticism methods. Having become aware of this trend, I began to convey my perspective on the benefits of metaphor consistency for the final artifact more often to the group toward the final part of the redesign process. At this point of the redesign stage, the instructor proposed that the newspaper metaphor, initially used for the feminist interpretation, might serve the goals of the instructional tasks for all four methods better than the city metaphor. On the one hand, the newspaper is directly linked to text interpretation, the core element of the biblical criticism. On the other hand, a newspaper office has various departments that can offer positions for all four types of jobs we had proposed for Metrotext. This approach also addressed a major flaw in the previous designs, that is, the inconsistency of the metaphors. The virtual newspaper offered a unified metaphor in the form of journalism careers for the overall environment.

Another advantage of this metaphor was its openness to various instructional strategies, allowing users to migrate both within the department from one career level to the next, and across departments from one type of job to another. This flexibility simulates both horizontal and the vertical career building patterns which are often found in real life situations. From a design perspective, the instructional tasks based on this metaphor can target either a) in-depth mastery of one method as students do progress through one job, or b) comprehensive mastery of several methods as students move from one job to another.

The new contextual metaphor then became “The Daily Intelligencer”—a virtual newspaper that had openings for several virtual jobs. The four virtual jobs intended to engage students in the four biblical criticism methods were a) Editorials & Opinions (Op-Ed) for feminist interpretation, b) Investigative Reporting for historical criticism, c) Movie section for narrative criticism, and d) Music section for redaction criticism. The structure of the learning tasks and their associated outcomes for the four biblical criticism methods simulated in The Daily Intelligencer are summarized in Table 5.1.

Appendix F presents more details regarding the technical aspects, general navigation, as well as specific tasks for one of the four methods. It also includes screenshots from The Daily Intelligencer.

5.1.4 The Strengths of the New Design

Because all instructional activities in the redesigned learning environment used the same metaphor and had the same instructional task structure, the new design allowed for a modular and dynamic implementation of the new online learning environment.

Table 5.1

Structure of Learning Tasks for Four Virtual Jobs Simulated in The Daily Intelligencer

	Intern task	Staff task	Gospel task
Feminist Interpretation: Editorials & Opinion (Op-Ed)			
Scaffolding	Worked example: five basic guiding questions developed by the expert and applied to a current newspaper article	Expert-guided reflection that introduces higher-level issues of hermeneutics of suspicion	Guided inquiry with built-in quick expert feedback for several gospel passages
Nature of task	Apply the basic questions to a similar newspaper article	Reflection on hermeneutics of suspicion applied to a news story different from the one for the intern task	Apply the method-specific inquiry strategy to a gospel passage indicated by the instructor.
Artifact	100-150 words essay	Letter to the editor (100-150 words)	700-800 words essay
Historical criticism: Investigative Reporting			
Scaffolding	Worked example: five basic guiding questions developed by the expert applied for two related newspaper articles	Expert-guided introduction of four certainty of knowledge criteria applied to intern worked example	Guided inquiry with built-in quick expert feedback for several gospel passages
Nature of task	Apply the basic questions to a specific issue in the two articles used in the worked example	Apply the four criteria of knowledge certainty to two articles as indicated by the instructor	Apply the method-specific inquiry strategy to a gospel passage as indicated by the instructor.
Artifact	100-150 words essay	100-150 words essay	700-800 words essay
Narrative criticism: Movie section			
Scaffolding	Worked example: three basic guiding questions on characterization developed and applied by the expert	Expert-guided reflection that introduces three major questions associated with the plot of a story	Guided inquiry with built-in quick expert feedback for several gospel passages
Nature of task	Apply the basic characterization questions to a well-known movie at choice	Write a review of a movie of choice after watching it with questions about plot and characters in mind	Apply the method-specific inquiry strategy to a gospel passage as indicated by the instructor.
Artifact	100-150 words essay	100-150 words essay	700-800 words essay

Table 5.1 - continuing

Structure of Learning Tasks for Four Virtual Jobs Simulated in The Daily Intelligencer

	Intern task	Staff task	Gospel task
Redaction criticism: Music section			
Scaffolding	Worked example: three basic guiding questions on how different song versions have different meanings	Guided inquiry with built-in expert feedback on the analysis of the impact of social settings	Guided inquiry with built-in quick expert feedback for several gospel passages
Nature of task	Apply the basic questions to the two versions of a song that has been recorded more than once	Write an analysis of a re-recorded song with focus on changes, transformation and social settings	Apply the method-specific inquiry strategy to a gospel passage indicated by the instructor.
Artifact	100-150 words essay	100-150 words essay	700-800 words essay

The redesigned learning environment used a single overarching metaphor which allowed for a more consistent instructional task structure to scaffold across the four biblical criticism methods. Consistency of task structure in turn allowed the development of a modular and dynamic version of the online learning environment. This functionality allowed the instructor to monitor the degree of students' completion of tasks throughout the various learning activities. The redesigned learning environment also offered a private working space for students and provided them with information regarding the completion of their tasks in real-time.

From a research perspective, the main strength of the job metaphor was that it allowed for a natural inclusion into the instructional task flow of specific measurements for individual descriptors, entry-level skills, and student growth. For example, the hiring process often requires applicants to complete knowledge, skills, and attitude surveys and/or tests for selection purposes, while procedures for gaining a promotion include periodical reviews of one's knowledge and skills.

Making the hiring application and survey part of The Daily Intelligencer increased the authenticity of the job metaphor and, in turn, helped students take a logical first step in deciding which job (i.e., method) they would prefer to master as part of the online activity.

5.2 Research Trajectory for the Second DBR Macro-Cycle

The research results from the first DBR macro-cycle provided the instructor with hard data that complemented his overall perception of the impact and weaknesses of the online environment. These results convinced the instructor to fully support a more in-depth analysis in the second DBR macro-cycle.

The research restrictions in the first DBR macro-cycle, related both to the design itself and to the implementation of the research trajectory, only allowed for a global examination of the online learning environment's impact on students' performance. That is, the impact of the actual learning tasks associated with the method used by the students could be inferred rather than demonstrated from students' short-text interpretation skills as measured in the first macro-cycle. For the second macro-cycle, the redesigned online learning environment allowed for improved monitoring of each student's completion of the learning tasks. The artifacts during each of the three stages of the online activity then served as input for a more thorough analysis of students' performance outcomes.

In addition, because the segment of the course that included the online learning environment scaffolded a new conceptual structure for understanding of the gospel texts, the research focus for the second DBR macro-cycle also included students' conceptual understanding of biblical criticism.

This expansion was justified by the fact that the segment of the course that included the online learning environment scaffolded a new conceptual structure for understanding the gospel texts. It was critical for future improvements to the learning environment to identify those aspects of the learning process that predispose students to misconceptions and/or oversimplification and, when needed, to find ways to build scaffolds to address these issues.

5.2.1 Theoretical and Empirical Grounds of Conceptual Understanding

The analysis of meaning and its relationship with knowledge representation caught the attention of the researchers in the cognitive science field after the concept of schemata was proposed by Bartlett (1932) to explain human memory (e.g. Norman, Gentner, & Stevens, 1976; Preece, 1976; Rumelhart & Ortony, 1977). Bartlett (1932) introduced *schemata* as constructs that actively organize past reactions. Further, because schemata become something with which the organism can work to react in a given context, “the organism discovers how to turn around upon its own ‘schemata’ or, in other words, it becomes conscious” (Bartlett, 1932, p. 208). Using this framework, Bartlett proposed that meaning is a more restrictive psychological construct than the situational contexts that generate it, and is constrained by one or more of the following three factors: a) conventionality, imposed through social groups; b) rationality, which asks to abstract from meaning the active and affective factors; and c) the fit of a given tendency or group of tendencies to another one.

With the growth of research in the field of information processing, new representational tools increased the interest in cognitive science towards schema theory and its applications for learning.

The main schema theory research lines focused on: a) linking schemata to memory representation through structural networks (Norman et al., 1976); b) defining methods and tools to map cognitive structures (Preece, 1976); c) representing knowledge in the memory as recursive conceptual structures embedded in hierarchies (Rumelhart & Ortony, 1977); and d) proposing instructional applications of schema theory (Pearson, 1984).

The introduction of mental models shifted the schema perspective from that of an image stored in memory to that of a representative sample in dynamic structures which mediate meaning by connecting internal conceptual structures and the external world of practice (e.g. Johnson-Laird, 1983, 1989; Jonassen & Henning, 1999). Johnson-Laird emphasized the importance of semantic structures for meaning-making models, as these structures allow “language to be used to create representations comparable to those deriving from direct acquaintance with the world” (Johnson-Laird, 1983, p. 397).

By integrating semantic structures with structural networks Thagard proposed a structure of conceptual systems that “consists of concepts organized into kind-hierarchies and part-hierarchies and linked to each other by rules” (Thagard, 1992, p. 30). This hierarchical approach of conceptual structures allowed for the analysis of various degrees of conceptual change, from adding a new instance of a concept to adding an entirely new concept, and to the reorganization of the hierarchies through branch- or tree-jumping (Thagard, 1990, 1992). This line of research, which focuses on the theoretical grounds of the conceptual change process, also includes: a) the evolutionary Theory of Synthetic Meaning (Vosniadou, 1992, 2002, 2003); b) the Revisionist Theory of Conceptual Change (Demastes, 1996; Strike & Posner, 1992); c) the revolutionary Theory of

Cognitive Conflict and Conceptual Change (Chinn & Brewer, 1993; Limon & Carretero, 1997); and d) the Theory of Conceptual Change through Ontology Shifting (Chi, 1992; Chi, Slotta, & deLeeuw, 1994; Pauen, 1999).

Another line of research on concepts and conceptual systems focuses on the measurement of the state of conceptual understanding. The state of conceptual understanding can be viewed as: a) the level of structural knowledge (e.g. Jonassen et al., 1993); b) the combination of the levels of both declarative and structural knowledge (e.g. Grotzer, 2002); or c) the combination of the levels of both declarative and structural knowledge (Jonassen et al., 1993, p. 4). The application of structural knowledge covers several aspects of the learning process. First, the instructors and researcher can build various representational tools to elicit the structural knowledge of both expert and novices and can determine knowledge gaps to be addressed (Jonassen et al., 1993). Second, complex conceptual patterns developed by experts can be conveyed to novices through instructional tasks that use explicit knowledge representation tools (Alonso-Tapia, 2002; Jonassen et al., 1993). Finally, instructional tasks that require the use of tools to represent one's own knowledge structures can help learners generate more complex structural knowledge by scaffolding their metacognitive skills (Grotzer, 2002; Jonassen et al., 1993; Magnusson, Templin, & Boyle, 1997). Several of these tools were used by the researchers to help identify needs and to develop instructional strategies for conceptual change. (e.g. Alonso-Tapia, 2002; Magnusson et al., 1997; Vosniadou, 2002). More recently, Jonassen (2006) proposed that the field of structural knowledge has significant potential implications for assessing conceptual change by offering tools to: a) elicit conceptual patterns; b) represent conceptual patterns; and c) assess concepts-in-use.

5.2.1.1 Representing Conceptual Patterns

Visually representing underlying conceptual structures that are associated with a given domain or task has proven to be one of the most powerful approaches in the analysis of conceptual understanding. Two main categories of representational tools have proven to be useful for the analysis of conceptual understanding (Jonassen et al., 1993). The first category includes tools used for representing statistical correlations among concepts elicited with methods such as free-word association, similarity ratings, or card sorts (Jonassen et al., 1993). Cognitive maps, also known as semantic maps, and Pathfinder networks are the two most prominent tools in this category (Jonassen, 2006). Of these, Pathfinder networks have a well developed algorithm to determine the least-weighted path out of a large amount of raw semantic proximity data resulting from a pair-relatedness judgment task (Jonassen et al., 1993). The drawback of Pathfinder networks is the relatively high number of pair-wise comparisons a participant needs to make, especially when having a big pool of concepts to represent. To avoid this drawback, Clariana (2002) proposes the ALA-Mapper (former S-Mapper) software as an alternative to the Pathfinder pair-wise rating task. This software allows subjects to drag up to 36 concepts around a computer screen and to sort them based on a given set of criteria. ALA-Mapper then returns a file with (x, y) coordinates for each concept. These distances between concepts are transformed in the association and proposition matrixes, the results of which can serve as input matrices for the Knowledge Network and Orientation Tool (KNOT). KNOT then converts these input matrices into network structures and provides the researcher with specific structural metrics (e.g. Clariana & Poindexter, 2004).

The second major category of representational tools switches the focus of analysis from statistical correlations between concepts to visual representations of these concepts. Concept maps, causal interaction maps, and graphic organizers are some of the methods in this category (Jonassen et al., 1993). Concept mapping is the most often used tool to both represent and to convey conceptual understanding. What typically differentiates concept maps from semantic maps is the fact that concept maps have labeled links that explicitly describe the relation between any two connected concepts. These links then generate sentence-like relationships between concepts reflecting the context in which the concept map was created (e.g. Jonassen, 2000a; Jonassen et al., 1993; Ruiz-Primo, Shavelson, Li, & Schultz, 2001). The major research issues associated with the use of concept maps for assessment are their reliability, validity, and practicality (McClure, Sonak, & Suen, 1999; Ruiz-Primo, Schultz, Li, & Shavelson, 2001; Ruiz-Primo, Shavelson et al., 2001), and their relationship with traditional assessment methods (e.g. Naveh-Benjamin, McKeachie, Lin, & Neely, 1998; Rice, Ryan, & Samson, 1998). Both categories of representational tools previously discussed have been used to compare students' level of structural knowledge against a set of benchmarking levels provided by experts (e.g. Clariana, 2002; Jonassen et al., 1993; Rice et al., 1998; Ruiz-Primo, Schultz et al., 2001).

5.2.1.2 Assessing Concepts in Use

The above-mentioned representational tools are unable to reveal the dynamic relationships among concepts that occur when they are applied in daily practice. Semistructured interviews and think-aloud protocols are the most common empirical methods used to assess concepts-in-use (e.g. Jonassen, 2006).

For example, to investigate the development of ninth-grade students' ideas about the structure of a set of rational numbers, Vamvakoussi & Vosniadou (2004) presented students with a questionnaire and asked them to think aloud as they answered each question. It is not uncommon to combine these two methods as part of a research process. For example, Magnusson et al. (1997) combined think-aloud protocols collected in the classroom with open-ended interviews conducted at the end of the school year to document elementary school students' conceptual change regarding electric circuits.

To conclude, the positive impact of conceptual understanding on meaningful learning has strong support, both theoretical and empirical. The latest theoretical and empirical developments in the field proposed and validated a series of research tools and models of conceptual understanding. These tools can help learning scientists find optimal ways to introduce scaffolds for conceptual understanding into the classroom. Indeed, some of these tools were used in the development of the second DBR macro-cycle's research trajectory.

5.2.2 Research Questions

One of the main goals of this research was to better understand how the inclusion of a Cognitive Flexibility Hypertext (CFH) as a scaffold for individual learning tasks can impact the learning of biblical criticism methods in a large, heterogeneous, undergraduate course. To address the complexity of learning processes that use technology-driven learning scaffolds such as CFH, Design-Based Research (DBR) with two successive macro-cycles was implemented for this study.

The research restrictions in the first DBR macro-cycle, related to both the design itself and to the implementation of the research trajectory, allowed only for a global examination of the online learning environment's impact on students' performance. For the second DBR macro-cycle, the redesigned online learning environment, The Daily Intelligencer, offered several features that favored more in-depth research of the learning associated with biblical criticism methods.

The main strength of this environment was that the new virtual job metaphor allowed for naturally including specific measurements of individual diversity descriptors into the online instructional task-flow. A second strength was including a self-monitoring feature in the online environment that allowed for a more consistent structuring of the online activities for the entire student body. In addition, the student measures and artifacts collected during each of the three stages of the online activity were well suited for use as input for a more thorough analysis of students' performance outcomes. Towards this analysis, the first question that was examined in the second DBR macro-cycle was related to students' performance in the online activity.

Research Question 1: What are the factors that significantly influence students' performance outcomes in online activity that used The Daily Intelligencer?

One of the major goals of introducing The Daily Intelligencer into the instructional process was to help novice students build and refine specific conceptual structures associated with biblical criticism methods. It was therefore critical to identify those aspects of the learning process that potentially weaken students' conceptual understanding (e.g. misconceptions, oversimplification) in order to further improve The Daily Intelligencer.

Because students' activities in The Daily Intelligencer were virtual for the researcher, an exit interview was conducted to identify students' conceptual networks associated with biblical criticism methods. This interview was conducted during Winter Semester of 2005 for a convenience sample of 38 students that used The Daily Intelligencer.

Concept mapping was used as the main method to elicit students' and expert's conceptual patterns. Two types of tasks, free concept association and method-based gospel analysis, were administered to broaden the range of cognitive skills captured in the elicited conceptual structures. Quasi open-ended questions were also administered to capture aspects related to the dynamics of the use of concepts associated with biblical criticism methods.

Four research questions associated with conceptual understanding of biblical criticism methods were examined in this study.

Research Question 2: To what degree did the instructional process that included The Daily Intelligencer foster students' conceptual understanding of biblical criticism methods, as measured by the closeness between students' and expert's conceptual networks ?

Research Question 3: To what degree did students' educational level, major, method used in the interview, and epistemic beliefs impact their conceptual understanding of biblical criticism methods, as measured by the closeness between students' and expert's conceptual networks?

Research Question 4: To what degree do the measures of students' conceptual closeness to the expert relate to the measures of students' performance in the online activity?

Research Question 5: After being exposed to the instructional process that included The Daily Intelligencer, to what degree did students' use of concepts associated with biblical criticism methods: a) support the quality of their structural networks; and b) reveal trends in building misconceptions and over-simplifications of knowledge?

CHAPTER 6

SECOND DESIGN-BASED RESEARCH MACRO-CYCLE: EMPIRICAL EVIDENCE OF LEARNING FROM THE SECOND DBR MACRO-CYCLE

6.1 Research Methods and Methodologies

6.1.1 Design

The redesigned online learning environment offered several features that improved the quality of the research data collected in the second Design-Based Research (DBR) macro-cycle. First, the alignment of the contextual and task metaphors allowed the researcher to include the demographic survey and the entry-level essay as tasks in the hiring process. Next, the fact that each student had his or her own account in The Daily Intelligencer made possible to assign the same text chunks for both the entry-level essay and the gospel essay. This feature created, on one hand, a better alignment between the entry and the exit online learning tasks and, on the other hand, allowed to inclusion of the reflection essay as an alternative assessment measure of students' performance in the Daily Intelligencer. Finally, the dynamic nature of the redesigned online environment allowed the inclusion of a built-in a task-completion feature. Each student was then constrained to navigate within the environment based on a predetermined sequence of instructional tasks. The progress in online activity was conditioned by the completion of some intermediary assignments. Along with the self-control functionality for the students, this feature allowed for a more consistent online engagement across all students.

Despite of all the improvements in the learning and research trajectories (e.g. improved consistency and synchronicity), the bulk of the students' learning activity in the Daily Intelligencer was still a virtual one for the researcher.

To better understand the learning of biblical criticism by the novice learners that used *The Daily Intelligencer*, a case study design was implemented for the second DBR macro-cycle. This case study used a mixed methods research approach with concurrent inquiry strategy that converge quantitative and qualitative data into a comprehensive analysis (e.g. Creswell, 2003; Tashakkori & Teddlie, 2003). The central part of the case study was an exit interview administered to both a convenience sample of students that voluntarily participated in this activity and to the instructor. For the same convenience sample, students' performance-related artifacts resulted from the online activities were retrieved and scored. Figure 6.1 presents a synthetic view of the research design used in the case study conducted for the second DBR macro-cycle.

6.1.2 Sample

The population of interest for this study was composed of all students enrolled in the Introduction to the New Testament course between January and May of 2005. A convenience sample of 38 students resulted from voluntary participation was used in this study. The incentive to participate was the possibility to obtain extra points for the completion of the exit interview.

On average, students that participated in this second Design Based Research (DBR) macro-cycle were 19 years old, with a range of 18 to 23 years old. Most participants were freshman (37%), followed by sophomores (26%), juniors (24%) and seniors (13%). The majority of the participants were female students (58%). For the 35 students that reported their GPA before enrolling in this course, the average score was 3.11, with a range of GPAs from two to four.

Using the four categories for majors developed in the previous DBR macro-cycle (see Appendix E) the 38 participants in this study were matched to: a) humanity studies (18%); b) social sciences (40%); c) hard sciences (34%); and respectively d) not decided (8%).

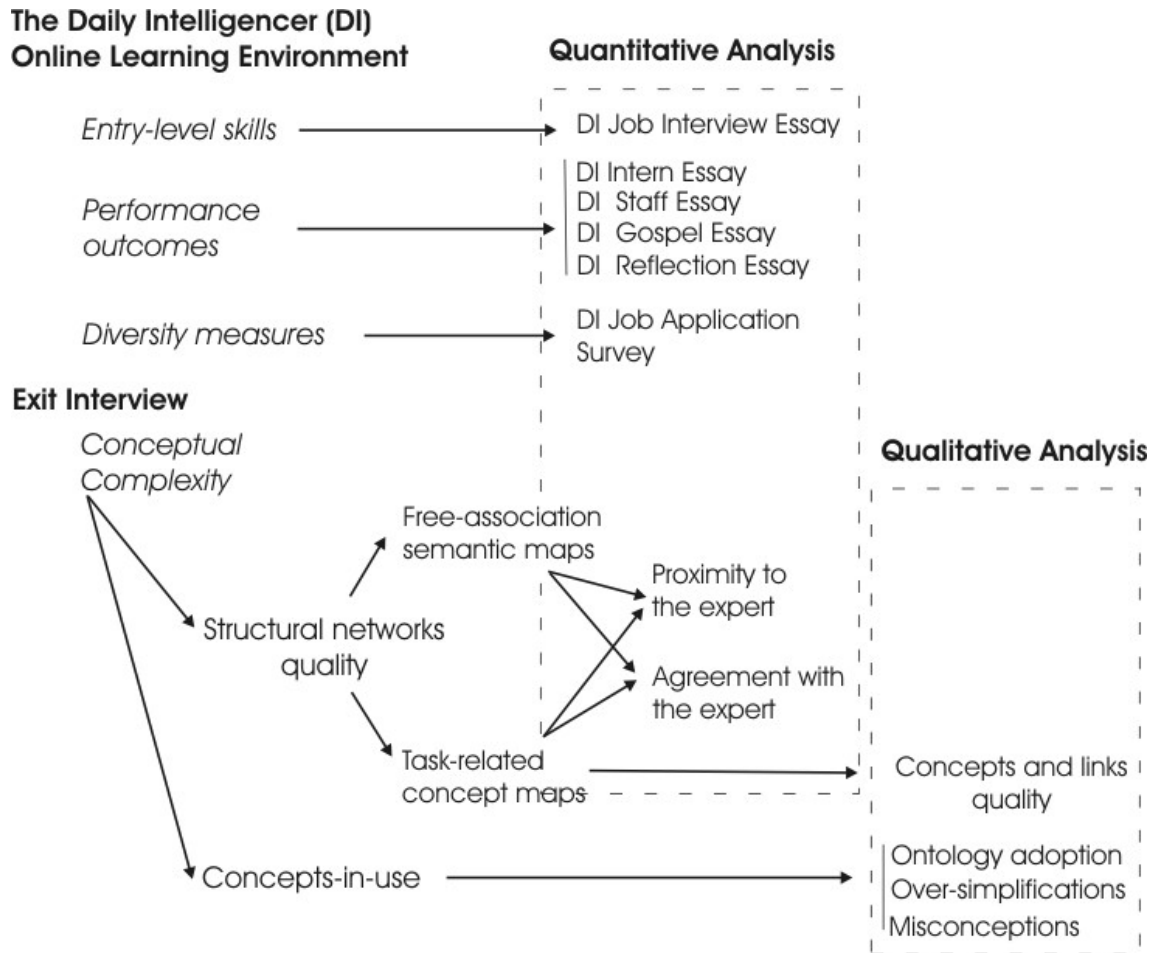


Figure 6.1 Case study analyses for the second Design-Based Research macro-cycle

Table 6.1 show that for the most of students' major demographic dimensions the assumption of a reduced bias toward a specific subgroup of the population was supported.

Table 6.1

Comparative Values of the Students' Demographics (Sample vs. Population)

Diversity Dimension		Population (n=111)	Sample (n=38)
Age	Min	18.00	18.00
	Max	23.00	23.00
	Mean	19.30	18.70
	Median	19.00	19.00
GPA	Min	2.00	2.00
	Max	4.00	4.00
	Mean	3.14	3.11
	Median	3.30	3.36
Gender [%]	Female	51	58
	Male	49	42
Repartition by Method [%]	Feminist	19	13
	Historical	26	29
	Narrative	27	29
	Redaction	28	29

*6.1.3 Measures and Measurements**6.1.3.1 Measures of Entry-Level Text Interpretation Skills*

As part of their job interview, students were presented with a text interpretation task that used the gospel passages from their final gospel essay in The Daily Intelligencer. Appendix G presents in the description of the task, the text(s) used, and the content scoring rubric used by the instructor for each method or group of methods. Following the same procedure as in the first DBR macro-cycle, the course instructor scored all entry-level essays for content. In preparing the essays for scoring the researcher placed them in a random order and removed all identification information. This measure was implemented to avoid any bias associated with scorer's perception of student's overall classroom performance.

The quality of argumentation rubric (see Appendix C) was the second type of scoring instrument used to determine the final performance score associated with students' entry-level skills. This rubric used a scale from 1 = *low quality of argumentation* to 5 = *high quality of argumentation*. Two raters, the researcher and another doctoral student in the field of learning sciences scored each essay. To maintain the consistency of scoring procedure all essays had identification data removed and were placed in random order for scoring. A two-step process was followed to ensure the reliability of the scores. First, ten randomly selected essays were initially coded by each of the coders, the differences in coding scores were discussed, and a final score was agreed upon. Next, another set of ten randomly selected essays were scored and the inter-reliability score was computed. Because the scoring was completed in one session by the same raters, the correlation among the ratings was computed to estimate the inter-rater reliability between the two raters (Sansone, Morf, & Panter, 2004; Trochim, 2001). The inter-rater correlation for the argument scoring was .72, $p < .05$. The differences in coding scores were then discussed, the final score agreed upon, and the process was repeated for the remaining of the essays. The final score for each essay resulted as the sum of the performance and the argumentation score, with a potential value ranging from 2 = *low overall performance* to 11 = *high overall performance*.

6.1.3.2 Measures of Student Performance in the Online Activity

The four artifacts that offered indicators of students' performance in the online activity were: the intern essay, the staff essay, the gospel essay, and the reflection essay. However, the scores available from the instructors for these artifacts were not usable in the research context.

For example, three of the artifacts, the intern essay, the staff essays, and the reflection essay were rewarded with points for completion rather than for the quality of the artifact. Also the intern and staff essays varied significantly both within and across the four methods (for more details see Table 5.1, page 75).

What linked all four artifacts was their focus on the contextual argumentation skills for which The Daily Intelligencer provided a series of inquiry-driven scaffolds. The quality of argumentation rubrics in the field of scientific and more recently socioscientific argumentation address the justification aspect of biblical interpretation (Driver, Newton, & Osborne, 2000; Sadler & Fowler, 2006). Building on this dimension, the scoring rubric on argumentation and persuasion proposed by Glasswell and colleagues (Glasswell, Parr, & Aikman, 2001, Appendix, Table 2) added to the rubric the context and language dimensions specific for biblical criticism essays. Three dimensions of the writing scoring rubric: to argue and persuade, purpose and position, flow of the language, and content of the argument were adapted for this study. The resulted scoring rubric used for scoring the intern, staff, and gospel essays resulted from the online learning activity is presented in the second part of the Appendix G. This rubric uses three subscales from one to four producing a total score from 3 = *low overall performance* to 12 = *high overall performance*. The scoring rubric was applied to the intern, staff, and gospel essays for each of the four biblical criticism methods by the researcher and the same second rater that helped with the scoring of the entry-level essays. The inter-rater correlation for the entry-level argument scoring was .84, $p < .05$. The internal reliability of the three subscales across the three categories of essays as measured by the Cronbach's Alpha was $\alpha = .80$.

Finally, the reflection essay was scored with two scoring rubrics, one for the content and the other for the overall argumentation skills, the second one being the same used for the entry-level essays. The content rubric for the reflection essay was created by expanding and adapting the content section of the writing scoring rubric to argue and persuade and presented in Appendix G. The reflection content rubric has five subscales with three levels from 0 to 1 producing a total score from 0 to 5. The internal reliability of the five scales as measured by the Cronbach's Alpha was $\alpha = .69$. The reflection content rubric and the quality of argumentation rubric were administered by the same two raters that followed the same procedure as in the previous two cases. The inter-rater correlation for the entry-level argument scoring was .78, $p < .05$. The final score for each essay resulted as the sum of the reflection performance score and the argumentation score, with a potential values ranging from 1 = *low overall performance* to 10 = *high overall performance*.

Instructors' scores for the midterm exam, following students' activity in The Daily Intelligencer, as well as the total scores for the course were also available to the researcher. One final remark is that the measures for the three categories of artifacts, the entry-level essay, the online activities essays, and the reflection essays have a common structure. All of these measures use rubric(s) that evaluate both the content and the argumentation structure. The scales used generated different total scores for the three categories of total scores and then all scores were converted to a range of 0 to 1 by dividing each score to the maximum score of its specific scale type. While this procedure does not change the variance of the respective variables, it produces comparable means for all scores.

6.1.3.3 Measures of Student Epistemic Beliefs

Similar to the first macro-cycle, the Epistemic Beliefs Inventory (EBI) was administered to all participants as part of the job application package (Schraw et al., 2002). The scale developed in the first DBR macro-cycle was used to measure students' epistemic beliefs for this second macro-cycle (see Appendix D, Table D2). The Likert response scale for the 15 items in the scale was 1 = "strongly disagree" and 5 = "strongly agree". Because of the reversed nature of the five dimensions in the EBI scale, the epistemic beliefs (EB) scores were computed as $EB = (EBI_{\max} + EBI_{\min}) - EBI$, and ranged from 15 = *min EB* to 75 = *max EB*. The internal reliability of the 15 items in the EBI scale as measured by the Cronbach's Alpha was $\alpha = .69$.

6.1.3.4 Measures of Conceptual Complexity Level from Free Concept Association Task

A first measurement of conceptual complexity level was performed using: a) the C-Mapper software developed by the researcher as an online version of the ALA-Mapper (former S-Mapper) software tool proposed by Clariana (2002); and b) the concept mapping software Inspiration (v7.5) produced by Inspiration Software ® Inc. The literature does not offer at this time validated methods to calibrate the measures resulted from the use of C-Mapper software tool. The set of equivalent maps resulted from instructor's use of both Inspiration and C-Mapper software was used to calibrate students' C-Mapper measures.

The number of concepts was selected according to Clariana's recommendation regarding the optimal distribution of concepts on the available screen space (Clariana, 2002).

The set of 36 concepts used for this study included: a) 26 major concepts selected by the researchers from all four methods used in The Daily Intelligencer (e.g. feminist criticism, narrative criticism, danger, main character, Mark, Luke); and b) 10 generic concepts with various degrees of association with religious studies (e.g. family, school, faith, meaning, or church). These 36 concepts were presented in a random order to the participants (see Appendix H for more details).

6.1.3.4.1. Measures resulted from using C-Mapper software. Half of the students, randomly selected, used C-Mapper software and were asked to group the 36 concepts on the screen based on their similarity. That is, the more alike the concepts were the smaller the distance between them had to be on the screen, and respectively the more different the concepts were the bigger the distance between them had to be on the screen. These rules applied to both horizontal and vertical dimensions on the screen.

Based on the organization of the 36 concepts on the screen, C-Mapper provided two arrays of coordinates for the 36 concepts (both X and Y axes). The two arrays of coordinates were then combined in a matrix of coordinates of all concepts C_A (36, 36). Additionally, a matrix of coordinates of task concepts C_T (26, 26) related to the biblical criticism tasks students used was created from C_A . That is, the rows and columns corresponding to the 10 generic concepts initially introduced in the analysis were eliminated from C_A . The auxiliary excel file that accompany the ALA-Mapper was used first to convert these matrixes of coordinates in distances between concepts, and then to generate the *distance array* for the set of concepts analyzed (Clariana & Poindexter, 2004).

Using the same software package, the distance array was converted in an *array of scaled distances*, defined as the percentage of the maximum distance in the given array. The scaled distances represent the relative closeness of each pair of concepts analyzed relative to the maximum coverage of the representational space (Clariana & Poindexter, 2004). Finally, to generate the actual *link array* that defined the structural network, the coefficient c , which I will call the *maximal closeness coefficient* - c , was used to convert each scaled distance in a binary value of 1 or 0. That is, if the scaled distance between any two concepts was smaller or equal to the c then a value of 1 was attributed to that given pair of concepts. The value of 1 then represented a significant link in the structural network specific for the analyzed link array. If this above condition was not true, then a value of 0 was allocated to that given pair of concepts.

The structure of the link array varies significantly with the choice of the maximal closeness coefficient c . The value recommended by Clariana (2002) as a starting point is $c = .30$, but there was no empirical evidence to support the choice of an optimal value for this parameter. The attempt made in this study to fine tune the value of c was based on the visual comparison of instructor's maps resulted from the use of C-Mapper software with those resulted from the use of Inspiration software for all 36 concepts included in the task. This analysis was possible because both types of maps were generated by the instructor with the same set of concepts, following equivalent free-association tasks. The yEd graph editor (v2.4.1) was used to represent the structural network of a given link array resulted from using C-Mapper. This graph editor is open-source software produced by yWorks GmbH and available online at: www.yWorks.com.

The instructor's structural networks for three link arrays resulted from values of c of .30, .20, and .10 were graphically represented with yGraph (Appendix I). The resulted structural networks were then compared with the analogue map generated with the Inspiration software. For the dataset used in this study, the structural network corresponding to the array link generated for $c = .20$ was the closest to the concept map generated with the inspiration software both as the density of links and the degree of concept clustering (see Appendix I for more details). A value of $c = .20$ was then used to generate students' structural networks associated with the free concept association task that used C-Mapper software.

Once the link arrays generated, the final step was to determine the closeness measures between the students' and instructor's conceptual networks. From a mathematical stand point the conceptual networks are labeled graphs similar to those analyzed in the social network analysis studies. In its social network analysis package, the statistical software *R* (v2.3.1) offers several metrics for the analysis of both individual and paired graphs. The result of a world-wide collaborative effort, *R* is an open-source language and environment used for statistical computing and graphics (for more details see <http://cran.r-project.org/>).

Two measures of graph closeness existent in the social network analysis statistical package available in *R* were used to evaluate the quality of students' conceptual networks. First, the hamming distance, represents the number of additions and/or deletions required to turn the link set in one network structure into that of a second network structure used as reference (Butts & Carley, 2001).

The hamming distance was therefore applied to compare the conceptual network proposed by the instructor with those resulted for each of the students participating in this study. The hamming distance is an integer value higher for less similar structures and smaller for more similar ones. Because hamming distance is an absolute measure sensitive to the number of edges of the compared graphs, the maximum of the reunions of common and uncommon edges for each set of graphs analyzed was used to normalize the value of this parameter. The normalized value of the hamming distance varied then between 0 for identical networks to 1, when the two graphs had no common links.

The second measure of map similarity used was the structural correlations between instructor's and students' conceptual networks. This is a direct measure of the closeness of two structures under comparison based on the theoretical exchangeability of vertices for each of the two structures (Butts & Carley, 2001).

6.1.3.4.2 Measures resulted from using Inspiration software. The other half of the participants were presented with a list of the same 36 concepts placed in random order and asked to use Inspiration software and build a semantic map that included all concepts and the proper links between them based on their perceived relationships. Next, these maps were converted into link arrays equivalent to the ones generated with C-Mapper software. A two-step procedure was developed for this task. First, for each of the 36 concepts in both students' and instructor's map generated in Inspiration a position id equal to the concept's position in the matrix of coordinates of all concepts C_A (36, 36) was manually allocated. Next, for every existent link between two concepts in the Inspiration map the value of 1 was attributed and then placed in the link array at the position corresponding to the intersection of the two liked concepts.

For example, if the fifth and seventh concept were linked in the Inspiration semantic map, then in the links array the position $c(5, 7)$ and respectively the position $c(7, 5)$ will get the value of 1.

Once all link arrays were generated for all 36 concepts, the coordinates of the 10 generic concepts were deleted to generate the link arrays for the 26 concepts related to the online biblical criticism tasks. These last link arrays were equivalent to those obtained from the matrix of coordinates of task concepts $C_T(26, 26)$ generated with C-Mapper by the other half of the students. Finally the two sets of link arrays were converted in the closeness measures between the students' and instructor's conceptual networks. Using the same procedure as for the array links generated with C-Mapper above described, the hamming distance and structural correlations were obtained.

6.1.3.5 Measures of Conceptual Complexity from the Near-Transfer Task

Because complex learning requires complex assessment tools, a second measure of conceptual complexity level was considered. If previously described measures were directed toward recall and recognition skills, this second set of measures was directed toward the analysis and synthesis skills. Two gospel texts selected by the instructor to be similar in length and complexity to those used by the students for their final tasks in the Daily Intelligencer were used. Students were presented with the two gospel texts and asked to analyze them using the biblical criticism method they felt more comfortable with (see the interview protocol in Appendix H). The instructor was asked to analyze the two texts using all four biblical criticism methods. The interviews took place in the week following the midterm exam and about two weeks past the submission of the gospel assignment in The Daily Intelligencer.

Participants were required to use Inspiration software to produce a concept map of their analysis using basic concept mapping strategies. That is, the participants were asked to create nodes for major concepts encountered in the analysis and then link them according to their relationships to each other. The participants were not required to produce predicative labels for the links and therefore the artifacts resulted from this task were unlabeled concept maps.

Due to the nature of the task, the resulted concept maps were not equivalent with respect of the concepts included in each structural network. A multi-step procedure was implemented to produce comparable structures between students' and instructor's concept maps. First, for each of the four methods the concepts from both the instructor's and students' concept maps were organized by the researcher in a three-column table. In the first column the concepts found in the instructor's map were placed in successive rows. The middle column, that mapped the row structure of the first one, was left empty. The third column, merged in a single cell, contained all concepts from students' maps that were not identical with each other or with one of instructor's concepts in the first column.

In the second step, the instructor was then asked to place students' concepts from the third column into the middle column into the row that corresponded to an equivalent concept in his map. The concepts left in the third column by the instructor after this step were not considered as valid and then excluded from the analysis. Next, the researcher produced for each of the four criticism methods an expanded expert map. Groups of concepts from the students' maps, rated by the instructor as equivalent to a given concept in his map, were placed in the corresponding place as one extra concept.

If the concept itself was not a dead-end node in the instructor's map then the extra concept made of the group of equivalent concepts from the students' maps was placed in addition to the existent concepts. For the dead-end node, the equivalent concepts from the students' maps were added to the dead-end node. The nodes in the expanded map were then numbered, starting from the original concepts in each of the four maps. The resulted expanded expert concept maps are presented in Appendix J.

Using the expanded expert concept map for each of the four methods, the researcher mapped expert's node number in students' concept maps. When two or more concepts in a given student concept map corresponded to the same expert concept, student's concepts were considered as one node and the duplicate links associated with this group of nodes were deleted.

Finally, the closeness measures between students' concept maps and expert's expanded map were calculated using the procedure described in chapter 6.1.3.4.2 above.

6.1.3.6 Sources of Data for the Qualitative Analysis of Conceptual Complexity Level

In qualitative research the information collected act as representations rather than measures of a given phenomena. The actual measures are then the result of the interaction between the researcher and the participants and reflect the fluidity of this interaction (Morse & Richards, 2002). Open-ended questions followed by prompts when proper were used to guide and stimulate the interaction between the researcher and the participants and generate the data sources for the final analysis.

To measure the dynamic aspects of concept-in-use complexity, participants were required to think aloud while they were performing the task and generating the concept map.

The think aloud protocol and the screen activity associated with the generation of the concept map were simultaneously recorded. The audio tracks were then converted to digital audio files and the think aloud protocols transcribed by a professional transcriber. The transcripts were then converted into digital formats suitable for the NVivo 2.0 qualitative analysis software.

6.1.4 Procedures

The integrated structure of the metaphors in The Daily Intelligencer allowed the researcher to collect students' diversity measures through tasks that were part of their online activity. Both the EBI questions and the demographic questions were part of the application package for the jobs offered by the virtual newspaper. Once the job application was submitted, students had access to all four job descriptions, one for each of the four biblical criticism methods. Students were encouraged to carefully read the descriptions of all jobs, decide on the type of job they would like to pursue, and apply for it, if openings were still available. To ensure a relatively equal distribution of the student body to the four methods, each job type had a predefined number of openings that were posted in the online environment. Job availability was dynamically updated to show, in real time, the number of jobs still open for each method.

Once the student had chosen a method, he or she was directed to participate in a virtual hiring interview for that position. The entry-level essay was administered as the hiring interview for the chosen job type. This task exposed students to the same gospel text(s) they used for their final essay in The Daily Intelligencer. The task in the virtual hiring interview was to write a short essay about the main point of the gospel text(s) presented to them.

Because the job interview is a common hiring practice, this step did not cued students on the nature and extent of their final assignment part of the online activity.

Following the entry interview that produced the entry-level essay, each student engaged in the instructional tasks specific for the biblical criticism method simulated through the virtual job. The tasks and the associated artifacts for all online jobs included: a) the training session followed by an internship assignment that resulted in a short essay; b) a more in-depth presentation of the method followed by a staff writer assignment that resulted in a second short essay; c) a gospel application introduction using worked examples followed by the major online assignment that resulted in a 800 words essay on given gospel text or texts depending on the method; and d) an optional reflection paper that simulated a job evaluation for career advancement purposes.

Once students completed all online tasks, an announcement was placed on both the Daily Intelligencer home page and on the WebCT main page letting them know about the possibility to earn extra points. The requirement was to participate in a 45 to 60 minutes exit interview in the week following their midterm exam, the concluding part of gospel segment in the course. Students that opted for the interview were directed to a scheduling website where they had first to read the informed consent to participate in the research. Then, if interested to participate in the interview they were required to select a date for the interview and enroll. An e-mail from the researcher confirming the date of the interview followed their enrollment. A reminding e-mail was also sent to each participant, one day prior to the scheduled interview. The scheduling conflicts that appeared between the registration and the interview date were solved via e-mails between the student and the researcher.

At the time of the interview, following the procedures required by the IRB, before engaging in the actual interview each participant was reminded that his or her participation was entirely voluntary. Then the researcher required the participant to read and sign the Informed Consent Form. The interview included four sections of which two were made of open-ended questions and the other two, the middle ones, included both a think aloud protocol and the use of a representational tool. Appendix H presents in detail the actual interview protocol, the materials used during the interview and the Informed Consent Form. For the two sections that required students to build a graphical representations of their analysis the researcher used a work space that included a laptop as the researcher's console and a monitor, a wireless keyboard and a wireless mouse as students' console (Figure 6.2).

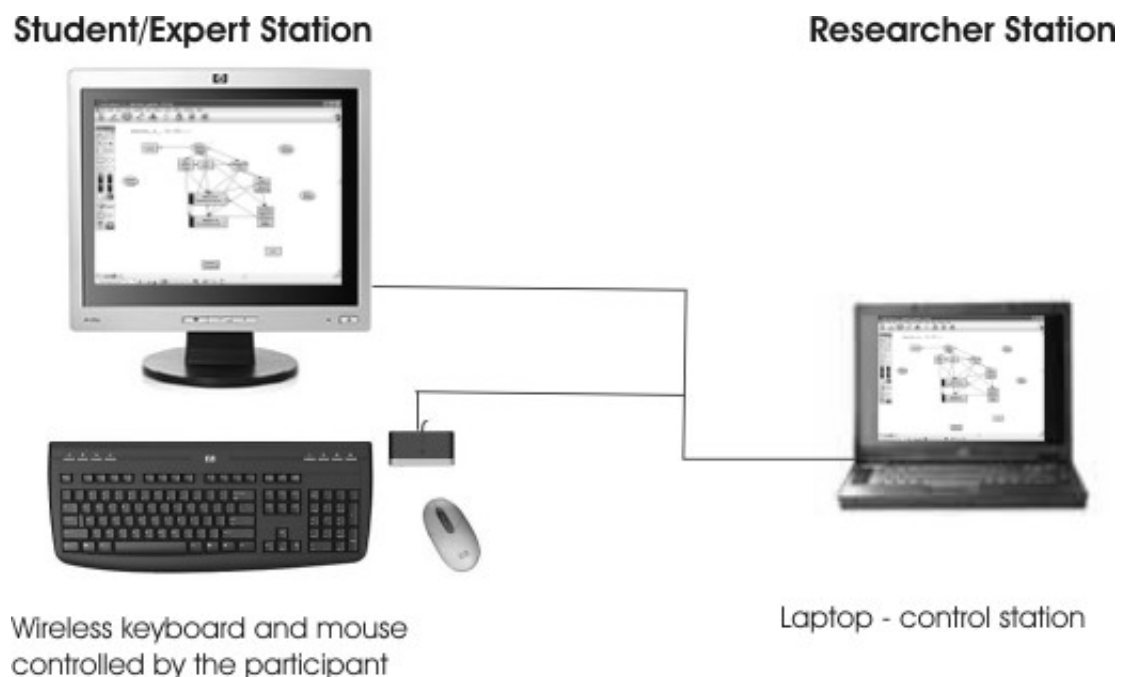


Figure 6.2 The structure of the interview workspace

The instructor was interviewed as the expert. The expert interview had several procedural adjustments as compared to student interview (see Appendix H for more details). The instructor was asked to produce concept maps for all four methods of interpreting the two gospel texts, and the semantic map using C-Mapper software. Due to the length of these tasks, the instructor completed the semantic map of the 36 concepts using Inspiration software in a second interview.

Three software packages were used during the interview. First, C-Mapper, an online version of S-Mapper (currently ALA-Mapper) software (Clariana, 2002) built by the researcher was used by half of the students, randomly selected, to produce a semantic map based on a set of 36 concepts. Second, Inspiration v7.5 software was used to produce both a semantic map with the same 36 concepts as in C-Mapper by the other half of the students and a concept map associated with the interpretation of two gospel passages by all students.

Finally, netu2's mediaCam AV software was used to record participants' on screen computer activity, along with audio, combining these elements into a single capture file. The main advantage of this software is that once recorded, the capture files can be reviewed, edited, and exported to various video and/or audio formats. The structure of the procedural steps and the associated data collected is synthesized in Figure 6.3. The data analysis and respectively the results and interpretation were therefore grouped by the type of the learning outcomes: a) students' performance in the online activities; and b) the complexity of students' conceptual understanding.

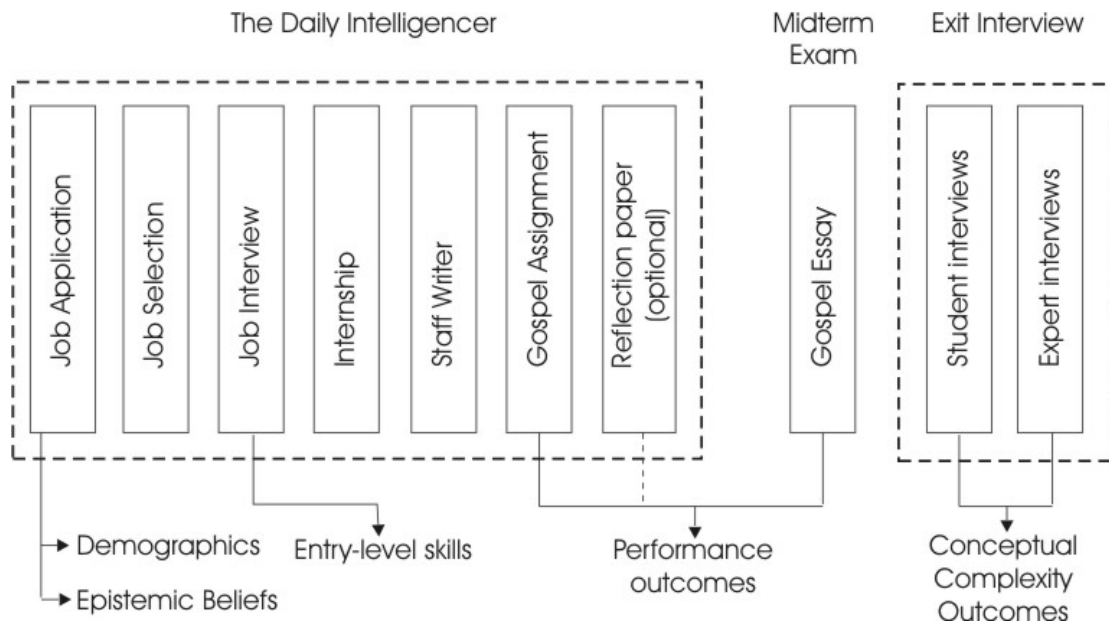


Figure 6.3 Procedures associated with data collection

6.2 Analysis of Students' Performance in Online Activities

Figure 6.4 presents the data analysis of students' performance for online activities in the context of the overall analysis for the second Design-Based Research (DBR) macro-cycle.

6.2.1 Data Analysis

The analyses of performance data include descriptive statistics, Pearson's correlations, and Structural Equation Modeling (SEM). Performance scores for the four measures were computed and entered into SPSS 13.0. AMOS Graphics 5.0 was used for the SEM analysis. The significance level chosen for this study was $p < .05$.

6.2.1.1 Dependent and Independent Variables

The five continuous variables used for this analysis were: entry-level essay score, intern-task essay score, staff-task essay score, gospel essay score, and reflection essay score.

The dependent variables were the intern-task essay score, the staff-task essay score, the gospel essay score and respectively the reflection essay score. The entry-level essay score was the only variable included in the analysis as independent variables.

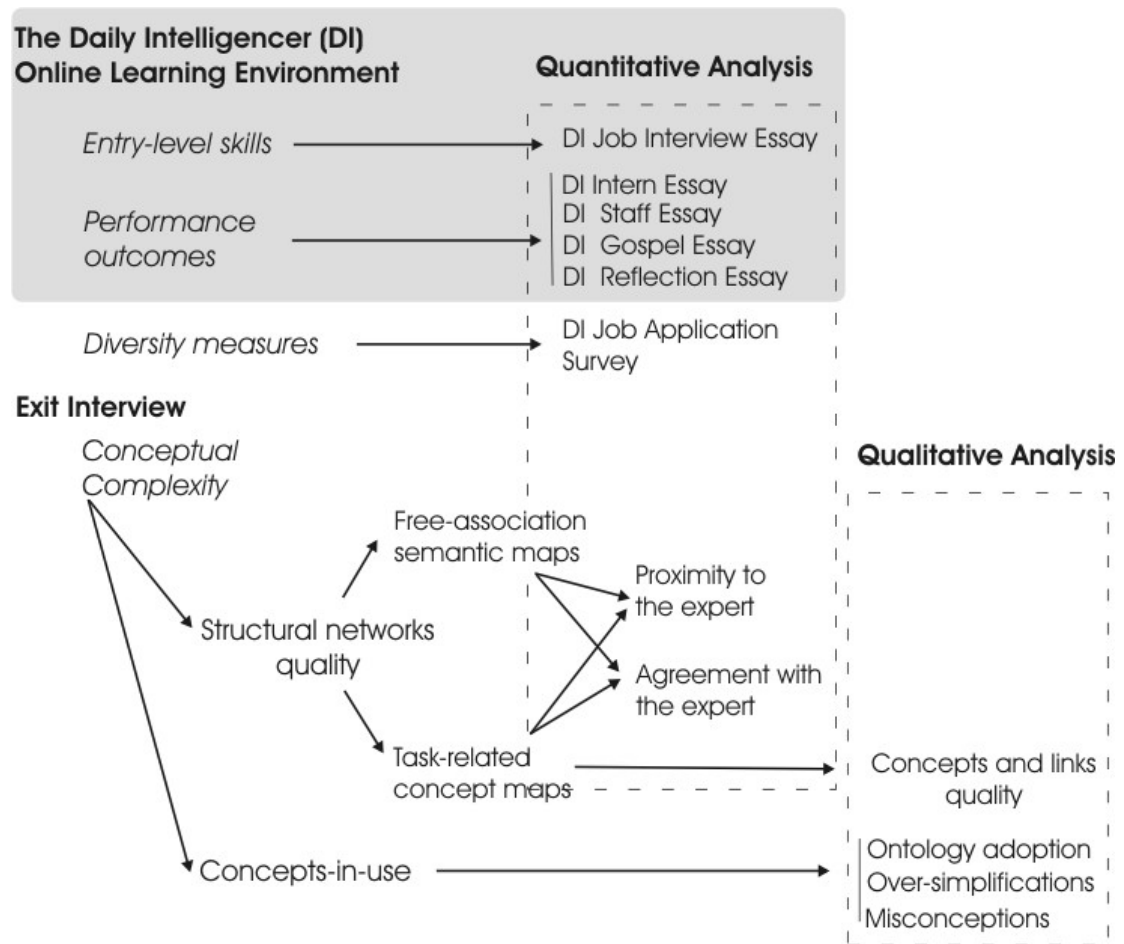


Figure 6.4 Data Analysis for Students' Performance in Online Activities

The data screening was a multi-step process. First, SPSS descriptive statistics were used to examine if all variables are within plausible ranges and that all means and standard deviations were plausible, given the dataset. Second, the data was screened for univariate outliers. Out of the 38 cases included in this analysis, no univariate outlier was identified, and therefore, the entire dataset was retained.

Then, the analysis of multivariate outliers using Mahalanobis distance (Tabachnick & Fidell, 2001, p. 93) indicated no multivariate outliers ($\chi^2_{\max} = 19.09 < 27.88 =$ Critical Value of Chi Square).

Missing data were found for the reflection essay scores of three students. The three essay were missing due to the voluntary nature of the reflection task and then they were rather random than nonrandom missing value. Considering, on one hand, the fact that randomly missing data have a low impact on the generalizability of the results (e.g. Tabachnick & Fidell, 2001, p. 58) and, on the other hand, the small sample size recruited for this study, a mean substitution was performed for the three missing values. The advantage of this procedure is that it is conservative and the mean for the distribution as a whole does not change (Tabachnick & Fidell, 2001).

Normality was a strong assumption for this dataset. The extreme values of -.683 for skewness and 1.592 for kurtosis across the five variables the dataset sustained the normality of the dataset. A more conservative measure of normality, Kolmogorov-Smirnov Test for entry-level essay ($K-S Z = 1.02, p > .05$), intern-task essay ($K-S Z = 1.0, p > .05$), staff-task essay ($K-S Z = .82, p > .05$), gospel essay ($K-S Z = .83, p > .05$), and reflection essay ($K-S Z = .65, p > .05$) strengthen the assumption of normality for this data set. Table 6.2 shows a synthesis of the descriptive statistics and correlations for the five variables in this dataset.

6.2.1.2 Measured variable path models

In The Daily Intelligencer, the scaffolds for the learning process were built using the theoretical model of the Cognitive Flexibility Theory (CFT).

The empirical research on CFT measured the aggregate impact of several criss-crossings of the cognitive landscapes on students' learning (e.g. Demetriadis & Pombortsis, 1999; Jacobson et al., 1996; Jang, 2000).

Table 6.2

Descriptive Statistics and Correlations of the Continuous Variables

	N	Mean	SD	2	3	4	5
1. Entry-level essay	38	.708	.140	.271	.423**	.200	.256
2. Intern-task essay	38	.669	.201		.109	.090	.162
3. Staff-task essay	38	.656	.259			.371*	.326*
4. Gospel essay	38	.700	.239				.156
5. Reflection essay	38	.697	.207				

Note: Coefficient of correlations significant at **p < .01, *p < .05.

This aggregate approach did not allow for an explicit analysis of the impact that each criss-crossing produces in the economy of the whole learning process.

Because the Daily Intelligencer was designed for novice learners, it was important to find to what degree the structure and the sequence of the criss-crossing scaffolds that were predefined for each biblical criticism method supported learners' knowledge and skills growth. For example, the intern task and the staff task exposed students to two non-Gospel scaffolds following a simple to complex structure. The gospel task then was designed to build on the previous method-specific knowledge level when moved the criss-crossing to the realm of Gospel interpretation. Each of these criss-crossings concluded with an assessment task which: a) allowed the instructor to monitor the completion of the learning tasks and provide quick formative feedback to the students when needed; b) allowed the students to produce artifact-based learning outcomes that reflected their knowledge growth; and c) provided the researcher with modeling variables associated with the impact of learning scaffolds used in cognitive flexibility hypertexts.

Path Analysis is a form of Structural Equation Modeling (SEM) that allows relationships between variables to be specified a priori for inferential purposes (Byrne, 2001; Kline, 2005; Pedhazur, 1997). Due to the independent nature of the two final outcomes used in this study two measured variable path models were proposed (Figure 6.5).

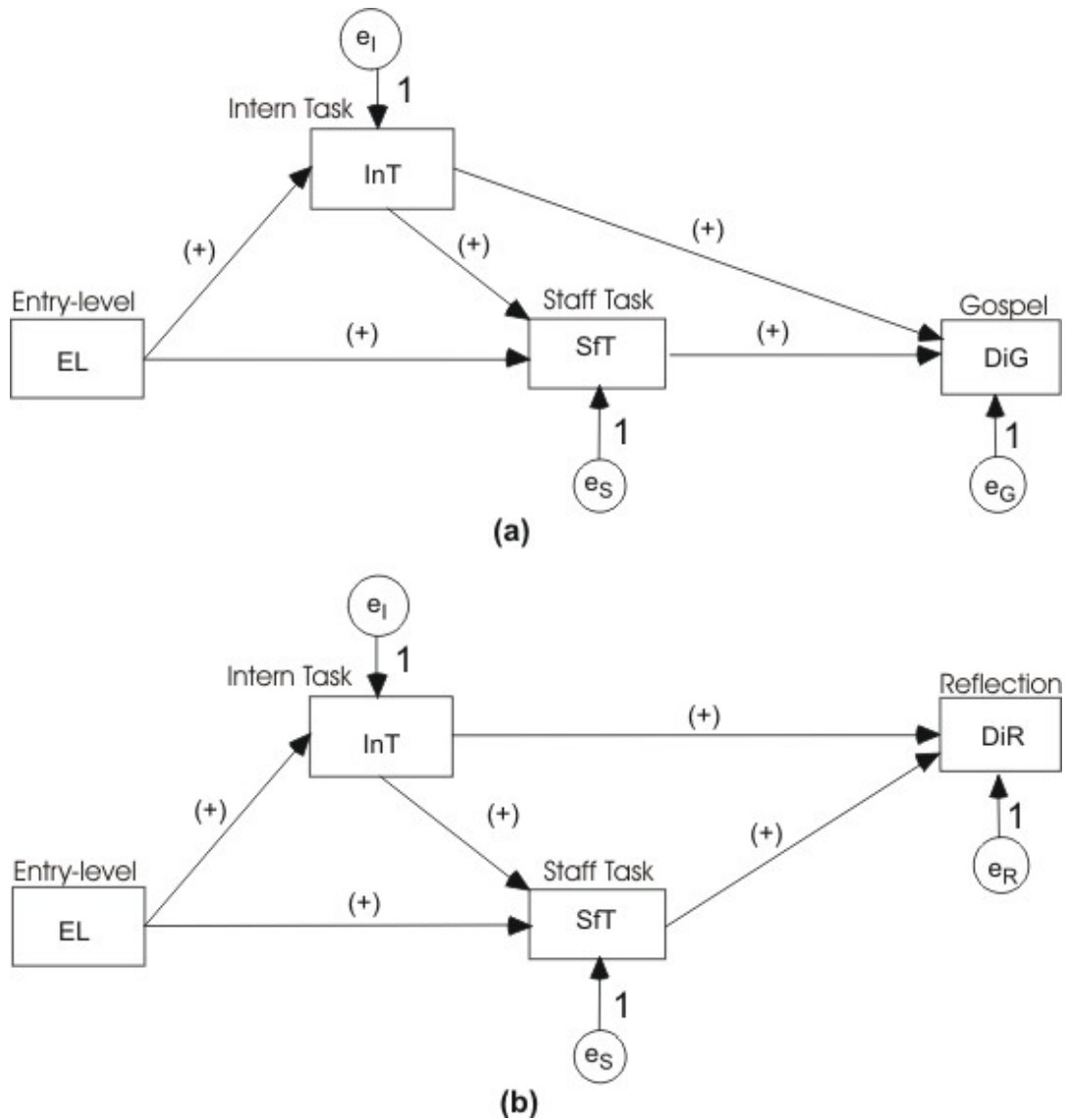


Figure 6.5 Measured variable path models for the two performance outcomes: a) gospel essay; b) reflection essay.

The intern task and the staff task served then as successive cognitive criss-crossings that mediated the growth of students' knowledge from the entry-level to the two final levels measured with: a) the gospel essay (Figure 6.5 a), and b) reflection essay (Figure 6.5 b).

The sample size was not within the limits of cases/parameter ratio recommended in the literature ($\geq 5:1$), and therefore the fit of the two models could not be assessed using the recommended measures used in SEM analysis (e.g. Byrne, 2001; Kline, 2005). However, both models were recursive and contained two just-identified mediating sub-models that shared a common path (intern task \rightarrow staff task). The path coefficients were therefore determined by reducing the analysis to the solution of two multiple regression analysis for each model (Pedhazur, 1997, pp. 765-781). Figure 6.6 presents the two adjacent recursive just-identified sub-models that were used for the multiple regression analyses for each of the two measured variable path models used in this study.

As shown in Figure 6.6 the first mediating sub-model (entry-level task \rightarrow intern task \rightarrow staff task) is common for both path models and therefore the paths associated with this sub-model will be determined only once. For each of the three independent causal sub-models defined for this study the correlation between an exogenous (independent) and endogenous (dependent) variable, or between two endogenous variables was decomposed in direct (path coefficient) and indirect effects.

Because the models are recursive (unidirectional causal flow) some endogenous variables were also conceived as independent variables with respect to another endogenous (dependent) variable.

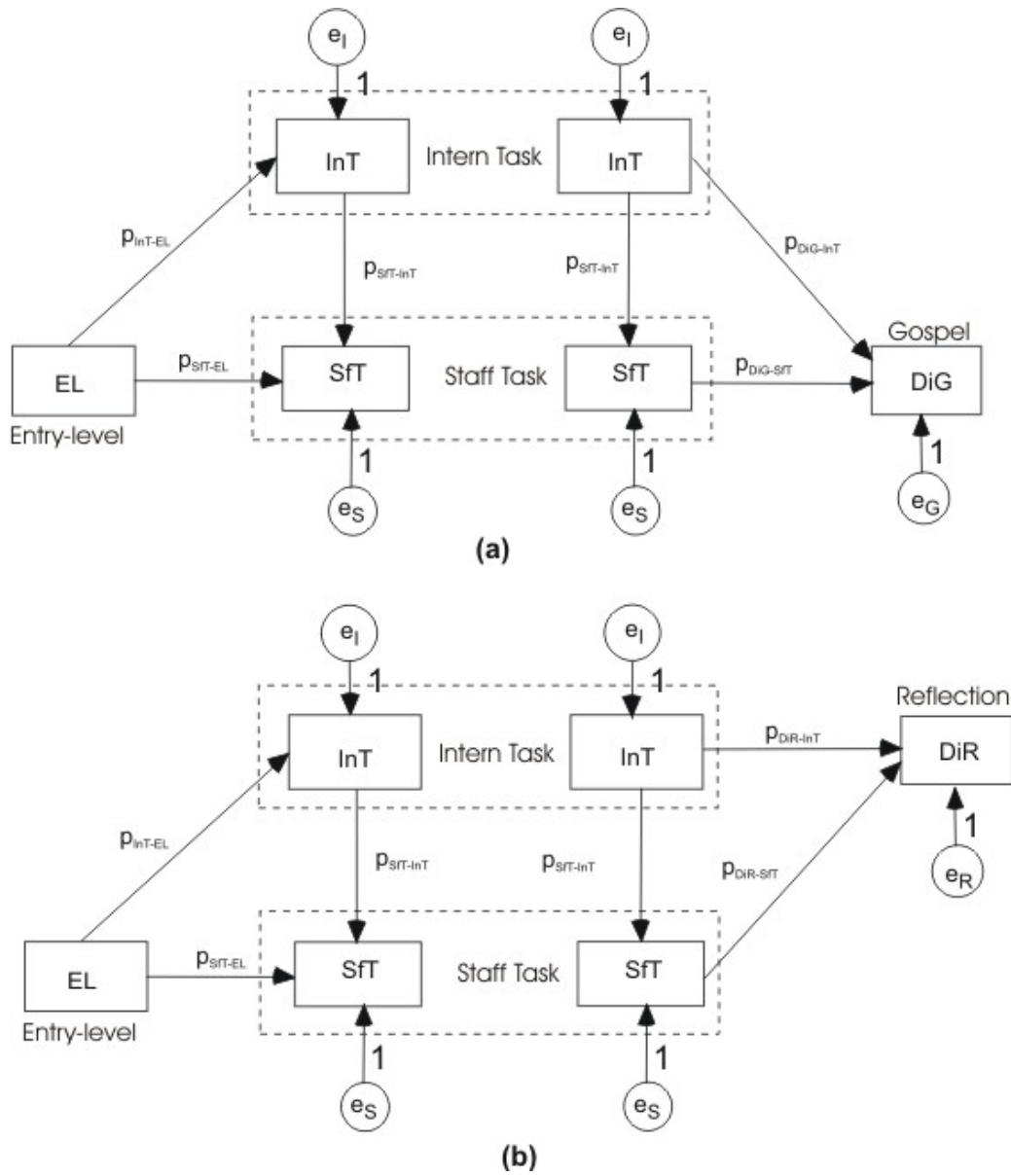


Figure 6.6 Recursive causal sub-models resulted from the proposed path models

For example, the intern task essay score was treated: a) as dependent variable with respect to entry-level essay score; and b) as independent variable with respect to the staff task essay score for the first mediating sub-model. On the other hand, the staff task essay score was treated as independent variable with respect to the gospel essay score and respectively the reflection essay score in their subsequent mediating sub-models (see Figure 6.6).

Each endogenous (dependent) variable was represented by an equation consisting of the variables on which it was hypothesized to be dependent and a residual e_i representing variables not included in the model. Because the residuals were assumed as not being correlated among themselves, the solution for the path coefficients take the form of the standardized regression coefficients (Pedhazur, 1997, pp. 772-774). Figure 6.7 synthesizes in a graphical form the path coefficients for the two proposed models.

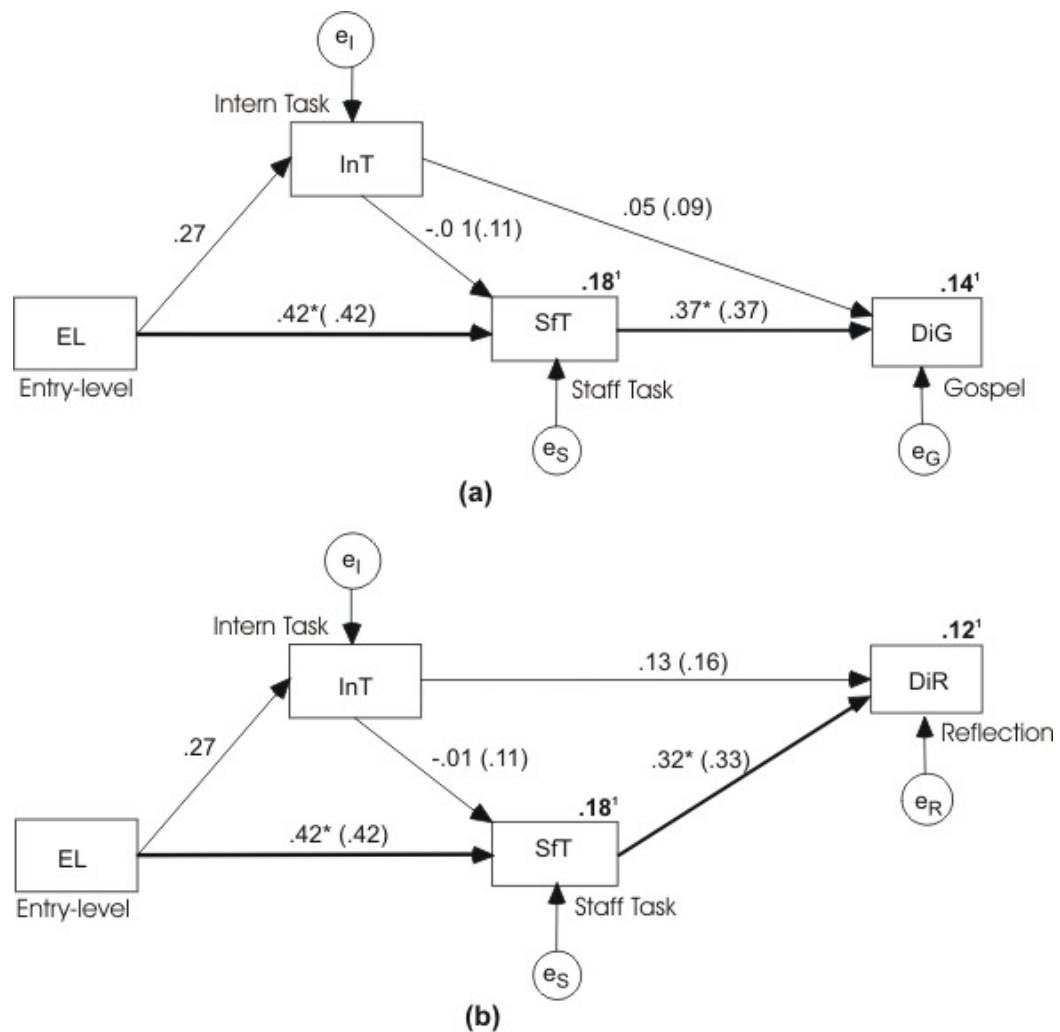


Figure 6.7 Path coefficients for the two models associated with students' online activities: a) gospel essay; b) reflection essay.

6.2.2 Results and Interpretation

Research Question 1: What are the factors that significantly influence students' performance outcomes in online activity that used The Daily Intelligencer?

Of the three paths hypothesized in each of the two models, two paths, one for each model, were found to be significant for students' learning in the online environment The Daily Intelligencer: a) *entry-level essay score* → *staff task essay score* → *gospel essay score* and b) *entry level essay score* → *staff task essay score* → *reflection essay score*. That is, the entry-level essay score was a statistically significant predictor for the staff-task essay score and respectively the staff-task essay score was a statistically significant predictor both for gospel essay score and the reflection essay score. The squared multiple correlations for the two models indicated that: a) 18 % of the variance associated with the staff-task essay score was explained mainly by the entry-level essay score; b) 14 % of the variance associated with the gospel essay score and 12% of the variance associated with the reflection essay score were explained by two predictors, the entry-level essay score and staff-task essay score.

There are two main potential factors that can explain the fact that the intern-task essay score does not explain at a statistically significant level a part of the final scores' variance, as was the case with the staff-task essay score. First, the scaffold for the learning process with the intern position was a worked example while the scaffold for the staff position was an expert-guided reflective inquiry which is better aligned than the worked example with both final tasks in online activity.

Second, the nature of the task for the intern and staff essay was different. For the intern essay the task was to replicate the inquiry strategy from the worked example provided as scaffold to a similar context, while for the staff essay the nature of the task was to expand, in the same context, the inquiry structure provided in the scaffold (see Appendix G for more details). On one hand, the outcome resulted from the staff task was more open and dependent on student's skills then better aligned with the final tasks. On the other hand, the outcome from the intern task reflected better the student's ability to map the instructor's example and therefore poorly aligned with the final tasks. A higher mean essay score (.669 for the intern essay as compared to .656 for the staff task) and a much lower skewness of the score distribution (-.094 for the intern essay as compared to -.237 for the staff essay) sustain the later assumption.

An interesting research question to approach is if a change of the nature of the task for the intern task to better align its outcome with the outcome from the staff-task will produce significant increase in the overall fit of the proposed model.

6.3 Analysis of Students' Conceptual Understanding of Biblical Criticism Methods

Figure 6.8 depicts the structure of the analysis of students' conceptual complexity in the context of the second DBR macro-cycle.

6.3.1 Analysis of the Closeness between Students' and Expert's Conceptual Networks

6.3.1.1 Data Analysis

To measure the closeness between students' conceptual networks with the equivalent expert conceptual network the analysis included: descriptive statistics, the measure of bivariate association using Pearson's correlations, paired-sample *t* test, independent-samples *t* test, and one-way ANOVA with one between-group factor.

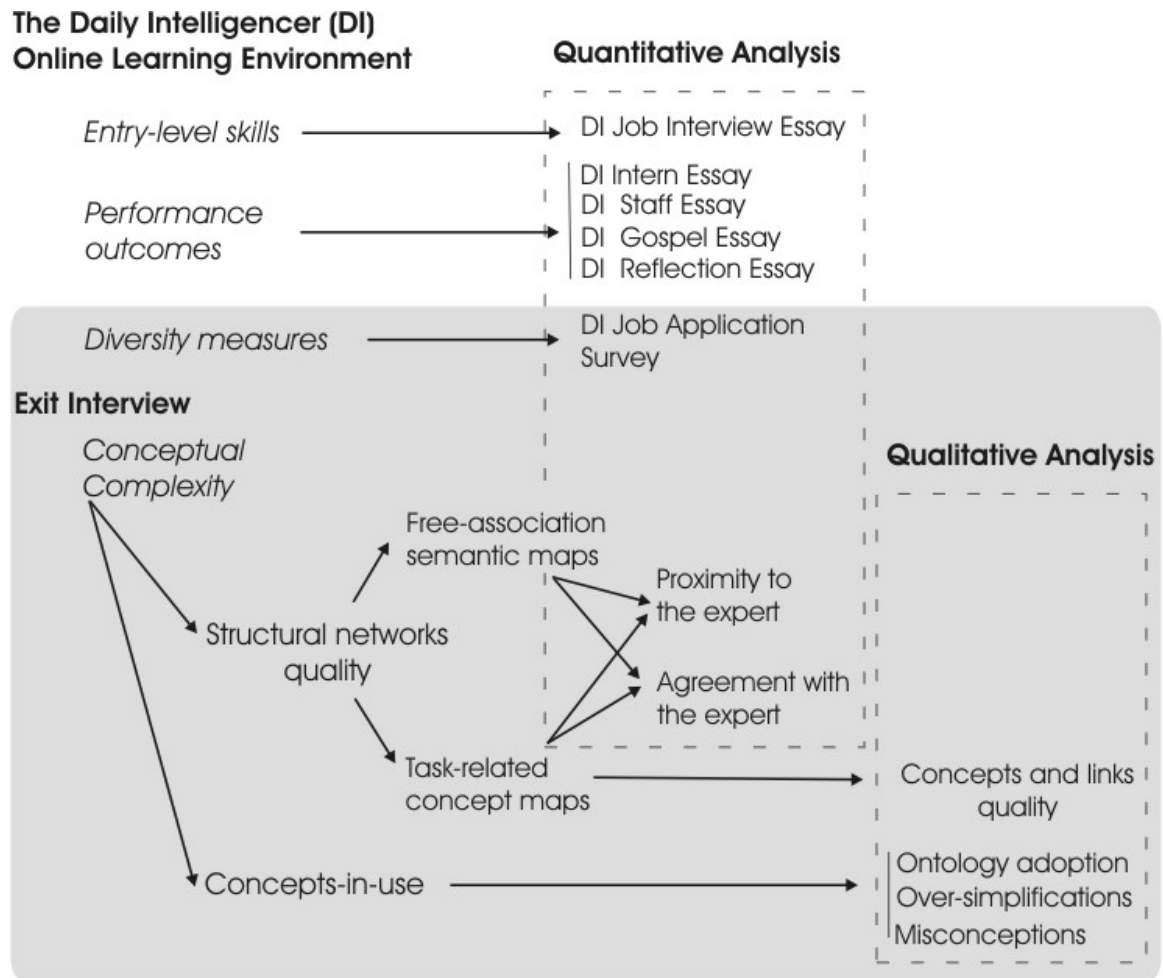


Figure 6.8 Data Analysis for Students' Conceptual Understanding of Biblical Criticism

Methods

6.3.1 Analysis of the Closeness between Students' and Expert's Conceptual Networks

6.3.1.1 Data Analysis

To measure the closeness between students' conceptual networks with the equivalent expert conceptual network the analysis included: descriptive statistics, the measure of bivariate association using Pearson's correlations, paired-sample *t* test, independent-samples *t* test, and one-way ANOVA with one between-group factor.

Two measures of the closeness between student' and expert's conceptual networks, the *distance* and respectively of the *agreement with* the expert for two complementary tasks were computed and then entered in SPSS 13.0.

The distance between students' and expert's conceptual networks was measured using a metric called Hamming distance borrowed from the graph theory and social network analysis. The Hamming distance represents the total numbers of edges between concepts that need to be deleted and/or added to make student's conceptual network identical with the one proposed by the expert. A low Hamming distance indicates a good proximity between student's and expert conceptual networks, while a high hamming distance indicates a poor proximity of the two conceptual networks. However, because the Hamming distance is tied to the number of links, its absolute value is sensitive to the total number of common and uncommon edges between concepts in any given set of conceptual networks to compare. The absolute value of the Hamming distance is therefore comparable when all maps analyzed are generated using the same set of concepts. To make this metric comparable across conceptual networks generated using different sets of concepts, the Hamming distance was normalized using the following procedure. For each set of conceptual networks used in this analysis, the expert's network was successively compared with each student network in the set. For each expert-student pair of conceptual networks in the set, the number of common (E_c) and uncommon (E_u) edges of the two networks were identified and summed ($E_t = E_c + E_u$). Next, for each string of E_t values, the maximum value $E_{t_{max}}$, was used to normalize the Hamming distances between students' and expert's conceptual networks in that set, $H_{ni} = H_i / E_{t_{max}}$.

After normalization, the value of the Hamming distance varied from zero, when the student and the expert networks were identical, to one when the student network had no common links with the expert network.

Agreement with the instructor was measured in this study using another metric borrowed from the graph theory and social network analysis, called structural correlation between two compared graphs or networks. Structural correlation is based on the convergence of patterns of edges in the compared conceptual networks (Butts & Carley, 2001). A high degree of exchangeability between the patterns of edges and concepts in the students and expert conceptual networks, indicate a high degree of agreement between the structures of concepts mapped in the two conceptual networks. The main advantages of this measure, as compared to the Hamming distance are: a) its independence on the number of concepts and links in the analyzed conceptual networks; and b) the possibility to use some criteria from the correlational analysis to evaluate the degree of agreement between the compared conceptual networks.

6.3.1.1.1 Dependent and Independent Variables. Six continuous variables were used: a) three distance measures determined with the hamming distance between students' and instructor's conceptual networks; and b) three agreement measures determined with the structural correlations between students' and instructor's conceptual networks. The six dependent variables were: a) Da , the hamming distance for conceptual networks generated with 36 given concepts, that included 26 method-related concepts and 10 generic concepts; b) Dm , the hamming distance for conceptual networks generated with the subset of 26 methods-related concepts; c) Di , the hamming distance for conceptual networks generated during the interview with Inspiration concept mapping

software while applying one of biblical criticism methods to given gospel passages; and d) *AGa*, *AGm*, and *AGi*, three structural correlations between students' and expert's conceptual networks, one for each of the three types of conceptual networks described for the hamming distances. Table 6.3 presents the five independent variables that served as descriptors of the student body diversity.

Table 6.3

The Independent Variables

Independent Variable	Conditions
Education level	1 Freshman (14) 2 sophomore (10) 3 junior and senior (14)
Student's major (see Appendix E)	1 humanities (n = 7) 2 social sciences (n = 15) 3 hard sciences (n = 13) 4 undecided (n = 4)
Criticism method used in the exit interview	1 feminist (n = 4) 2 historical (n = 8) 3 narrative (n = 15) 4 redaction (n = 11)
Epistemic Beliefs	1 low EBI (≤ 38) (n = 18) 2 high EBI (> 38) (n = 20)

6.3.1.1.2 Research assumptions. Independence of observations was assumed. The assumption was that participants' responses for the method-related gospel analysis task were not influenced by their responses to the free concepts association task.

6.3.1.1.3 Data preparation and screening. The data screening was a multi-step process. First, descriptive statistics were run using the SPSS statistical software package and used to examine if all variables are within plausible ranges and that all means and standard deviations were plausible, given the dataset.

Second, the continuous variables were screened for univariate outliers. Out of the 38 cases included in this analysis, no univariate outliers were identified, and therefore, the entire dataset was retained. The analysis of multivariate outliers using Mahalanobis distances (Tabachnick & Fidell, 2001, p. 93) indicated no outliers as well ($\chi^2_{\max} = 17.44 < 26.13 = \chi^2_{\text{critical}}$).

Normality was a strong assumption for this dataset. The extreme values of -.484 for skewness and of -1.039 for kurtosis across the six continuous variables supports the assumption of normality of the dataset. A more conservative measure of normality, Kolmogorov-Smirnov Test strengthened the assumption of normality for this dataset: *Da* (K-S $Z = 1.06, p > .05$), *Dm* (K-S $Z = .61, p > .05$), *Di* (K-S $Z = .61, p > .05$), *AGa* (K-S $Z = .72, p > .05$), *AGt* (K-S $Z = .57, p > .05$) and, *AGi* (K-S $Z = .56, p > .05$). Table 6.4 presents an overview of the descriptive statistics and correlations for the continuous variables used in this study.

Table 6.4

Descriptive Statistics and Correlations of the Continuous Variables

	N	Mean	SD	2	3	4	5	6
1. <i>Da</i>	38	.70	.14	.90**	.04	-.74**	-.69**	.05
2. <i>Dm</i>	38	.64	.13		.04	-.59	-.67**	.04
3. <i>Di</i>	38	.74	.12			-.11	-.09	-.24
4. <i>AGa</i>	38	.51	.07				.67**	.10
5. <i>AGm</i>	38	.53	.08					.09
6. <i>AGi</i>	38	.38	.10					

Note: Coefficient of correlations is significant at ** $p < .01$.

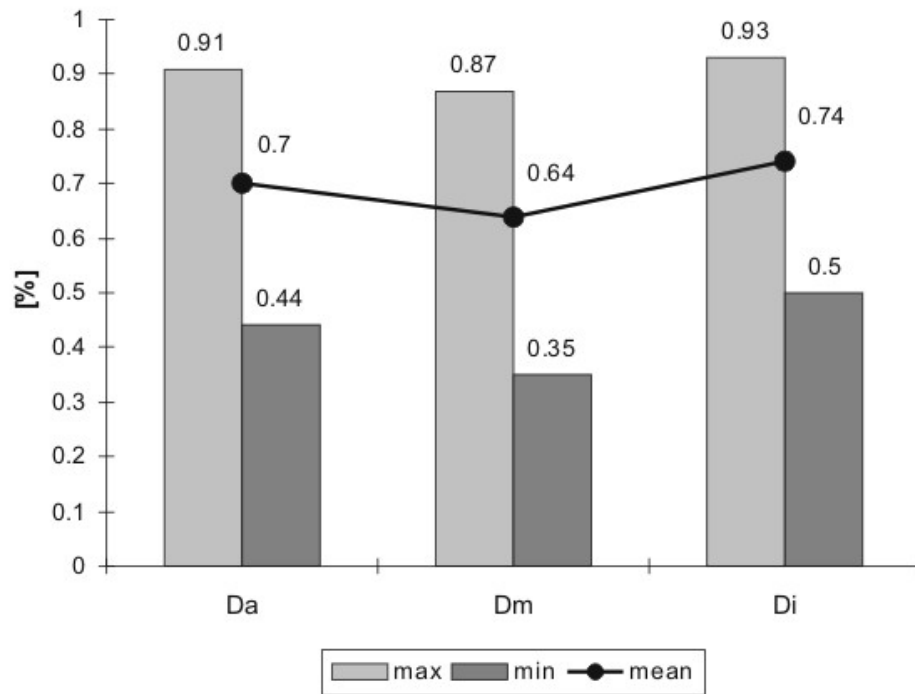
6.3.1.2 Results and Interpretation

Research Question 2: To what degree the instructional process that included Daily Intelligencer fostered students' conceptual understanding of biblical criticism methods, as measured by the closeness between students' and expert's conceptual networks ?

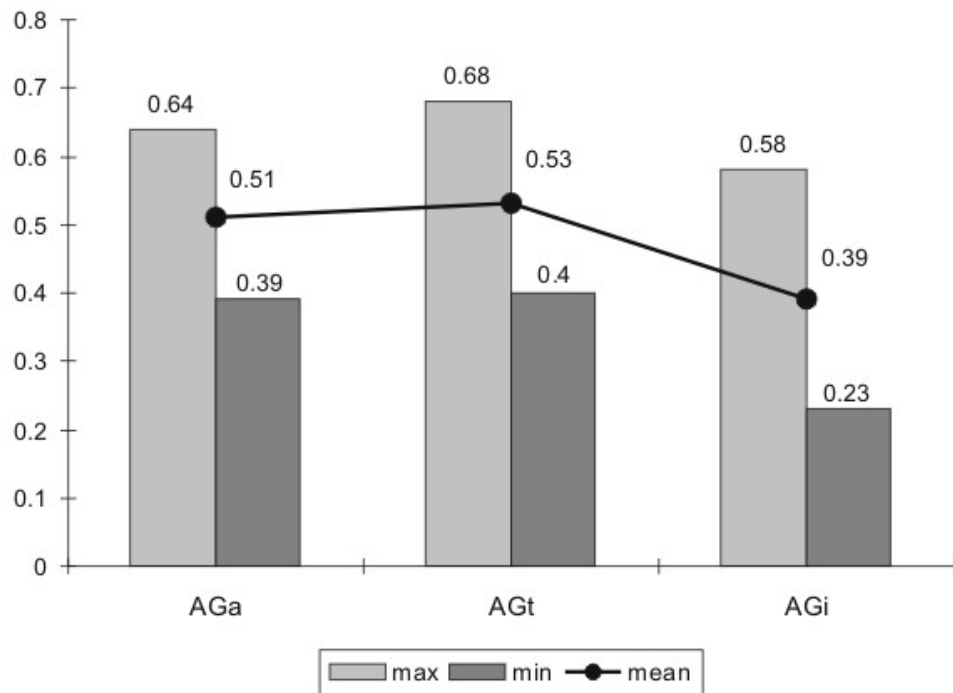
The analysis of the basic descriptive statistics provides the first insights of the closeness between students' and expert's conceptual networks. Figure 6.9 graphically depicts the variation of mean, minimum, and maximum values of the two categories of measures, distance and agreement, for the three categories of conceptual networks resulted from: a) free-association semantic maps generated with both methods-related and generic concepts; b) free-association semantic sub-maps generated only with methods-related concepts; and c) concept maps generated while applying one of the four biblical criticism methods to given gospel passages.

The distance between students' and expert's conceptual networks resulted from the free concept association task (Da , Dm), and from the near-transfer task (Di) were analyzed using a paired-sample t test. This analysis revealed a significant difference between Dm and Di , $t(37) = -3.86$, $p < .05$ but failed to reveal a significant difference between the Da and Di , $t(37) = -1.50$, $p = .14$.

The sample means showed in Figure 6.9a suggest that mean distance resulted from the subset of method-related concepts used in the free concept association task, Dm ($M = .64$, $SD = .13$), was significantly higher than the mean distance resulted from the near-transfer task that required students to analyze gospel texts Di ($M = .74$, $SD = .12$).



a) Distance between students' and expert's conceptual networks



b) Agreement between students' and expert's conceptual networks

Figure 6.9 Measures of the closeness between students' and expert's conceptual networks

The mean distance from the free concept association task for all 36 concepts, Da ($M = .70$, $SD = .14$), was quite similar to the mean distance resulted from the near-transfer task which required students to analyze gospel texts Di ($M = .74$, $SD = .12$).

Figure 6.9b shows the variation of the agreement between students' and expert's conceptual networks. Paired-sample t-test was used to analyze the agreement between the students' and expert's conceptual networks resulted from: a) the free concept association task (AGa , AGm); and b) the near-transfer task (AGi). The analysis revealed a significant difference between: a) AGa and AGi , $t(37) = 6.40$, $p < .05$; and b) AGm and AGi , $t(37) = 7.07$, $p < .05$. The sample means showed in Figure 6.9b suggest that the mean agreement between the student's and expert's conceptual networks resulted from the free concept association task with all 36 concepts, AGa ($M = .51$, $SD = .07$), and the mean agreement resulted from the subset of 26 method-related concepts used in the free concept association task, AGm ($M = .53$, $SD = .08$) were significantly higher than the mean agreement between students' and expert's conceptual networks resulted from the near-transfer task that required students to analyze gospel texts AGi ($M = .39$, $SD = .10$).

The two categories of measures of students' closeness to the expert indicated a similar trend for the two tasks used to elicit students' and expert's conceptual patterns. When required to recognize associations among concepts in a given set used in the biblical criticism methods, students' conceptual networks were significantly closer to the expert than when they were required to analyze a gospel passage.

Among the concepts that students were able to correctly map were the four criticism methods and their related concepts such as multiple attestation, certainty, main character, opponents, liberation (see Appendix H for more details).

The results of the analysis of the agreement between students' and expert's conceptual networks for the two types of tasks supported this finding. Values of agreement from .4 to .68 between the students' and the expert's conceptual networks were a strong indicator of student's ability to recognize and correctly map major concepts used both in lectures and the online learning environment.

In contrast, when the nature of the task involved analysis and synthesis skills, the mean agreement between the student's and the expert conceptual networks was significantly lower. For 55% of the students participating in this study, the agreement between their and expert's conceptual networks in the near-transfer task ranged from .23 to .4. This range was below the minimal level of the agreement of their and expert's conceptual networks for the free concept association task with method-related concepts (see Figure 6.9b). These results suggested that a gap existed between the students' ability to recognize and to represent conceptual structures associated with biblical criticism methods. This gap may be approached in future stages of the Design-Based Research process.

Research Question 3: To what degree students' educational level, major, method used in the interview, and epistemic beliefs impact their conceptual understanding of biblical criticism methods, as measured by the closeness between students' and expert's conceptual networks?

For the purpose of this study, results were analyzed using five one-way ANOVA between-group designs.

The differences between the various levels of education level, major, educational level, and method used in the interview were analyzed for all six measures of the closeness between students' and expert's conceptual structures (*Da*, *Dm*, *Di*, *AGa*, *AGm*, and *AGi*). Out of these analyses, only two revealed a significant effect:

a) A significant effect was found for the type of method used in interview with respect to the distance between students' and expert's conceptual networks resulted from the near-transfer task that required students to analyze gospel texts *Di*, $F(3, 34) = 15.07$, $p < .05$. The sample means for distance are displayed in Figure 6.10. The post-hoc Bonferroni test showed that students in the historical criticism group had significantly lower mean distance between students' and expert's conceptual networks than those in the feminist, narrative, and redaction groups, $p < .001$.

b) A significant effect was found for the type of method used in interview with respect to the agreement between students' and expert's conceptual networks resulted from the near-transfer task that required students to analyze gospel texts *AGi*, $F(3, 34) = 3.57$, $p < .05$. The sample means for structural correlations are shown in Figure 6.11. The post-hoc Bonferroni test showed that students in the historical criticism group had significantly higher mean agreement between student and expert conceptual networks than those in redaction group, $p < .005$.

Table 6.5 summarizes the analysis of variance for the criticism method used in the interview. A summary of the analyses of variance for the independent variables that failed to reveal a significant effect was included in Appendix K.

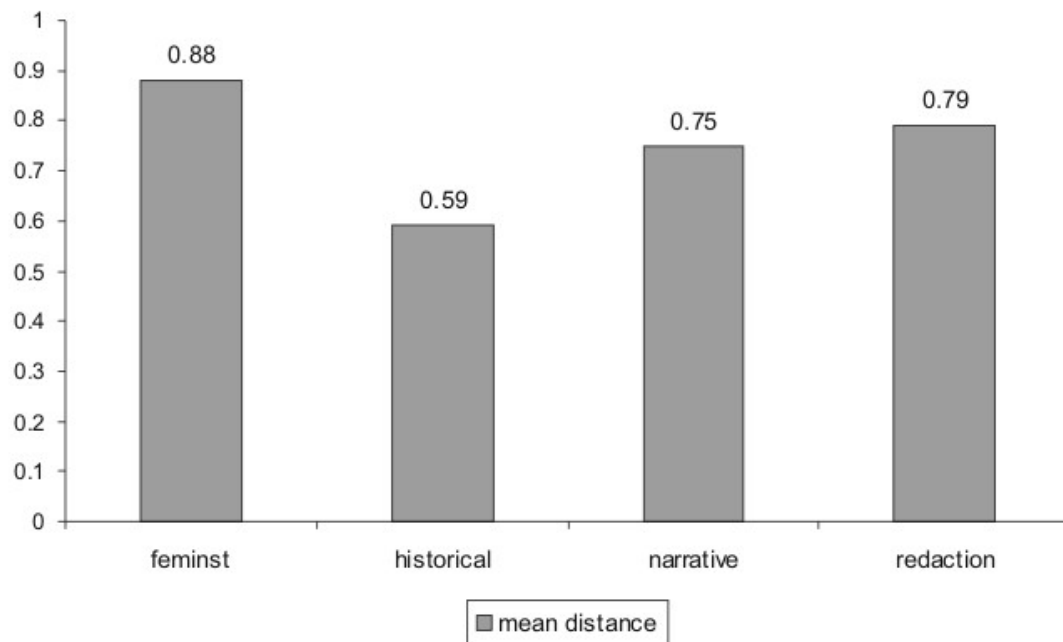


Figure 6.10 Sample means for the distances between students' and expert's conceptual networks

With one exception, this study found no significant effect for the five categories of students' diversity measures on the two measures of the closeness between students' and expert's conceptual networks.

Table 6.5

Analysis of Variance for the Method Used in the Interview

Source	<i>df</i>	F	η^2	Observed Power
Between subjects				
Distance <i>Di</i>	3	15.07**	.57	1.00
Error	34	(.01)		
Agreement <i>AGi</i>	3	3.57*	.24	.74
Error	34	(.01)		

Notes: Values enclosed in parentheses represent mean square errors; * $p < .05$. ** $p < .001$

The small sample size, as well as the low effect size and power revealed by these late analyses weakened the validity of the following conclusions.

The criticism method used in the exit interview was the only category that revealed a significant difference for both measures of the closeness between students' and expert conceptual structures, *but only for* the near-transfer tasks that required students to analyze gospel texts.

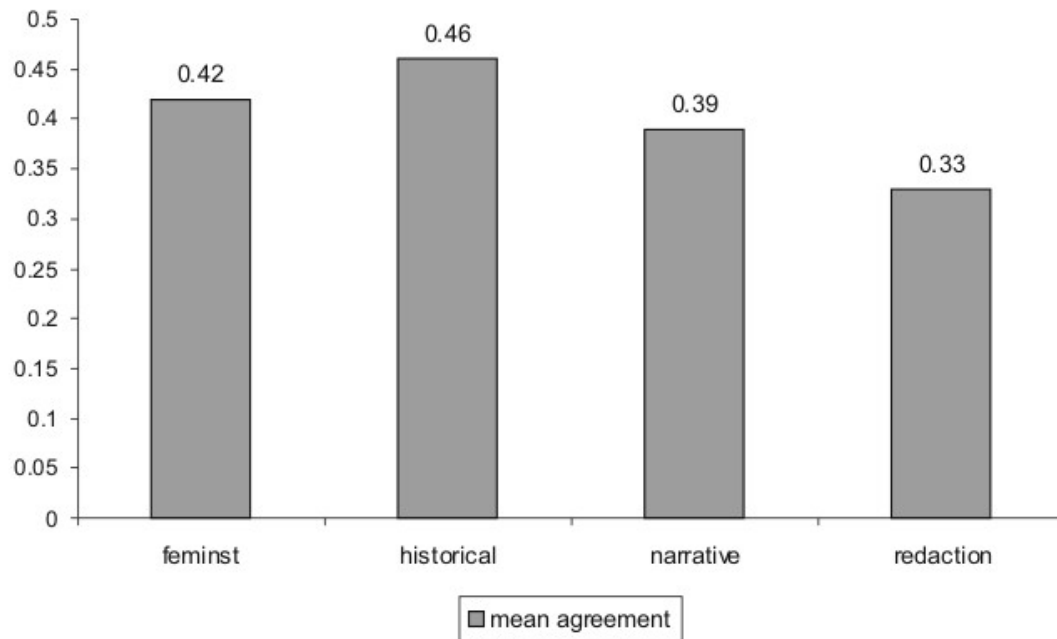


Figure 6.11 Sample means for the agreement between students' and expert's conceptual networks

Students in the history criticism group were significantly closer to the expert with respect of their conceptual structure associated with the analysis of gospel texts, as compared to students in redaction group. From a design perspective this finding was encouraging considering that in the first DBR macro-cycle the research results indicated that history group scored significantly lower than the other three groups on the posttest measure of text interpretation skills. The effort to align the effectiveness of the online scaffolding for all four methods produced therefore a positive result with The Daily Intelligencer.

Research Question 4: To what degree the measures of students' conceptual closeness to the expert are related to the measures of students' performance in online activity?

Staff task essay score, gospel essay score, and reflection essay score all significantly influenced students' performance in the online activity that included The Daily Intelligencer (see *Research Question 1*). Pearson correlations were used to determine the nature of the relationship between these measures and the two types of measures of students-expert conceptual closeness (distance and agreement). Table 6.6 presents the Pearson correlation coefficients for the two sets of variables.

Table 6.6

Intercorrelations between Performance Outcomes and Structural Understanding

Measures

	Staff-task essay score	Gospel essay score	Reflection essay score
Hamming distance between Students' and Expert's Conceptual Network			
Free concept association: all concepts (<i>Da</i>)	.08	.00	-.05
Free concept Association: method-related concepts (<i>Dm</i>)	.11	.07	-.09
Transfer task Inspiration Concept Map (<i>Di</i>)	-.15	.18	-.18
Structural Correlations Between Students' and Expert's Conceptual Networks			
Free concept association: all concepts (<i>AGa</i>)	-.05	.10	-.08
Free concept Association: method-related concepts (<i>AGm</i>)	-.10	-.02	-.07
Transfer task Inspiration Concept Map (<i>AGi</i>)	-.07	-.12	.03

Pearson correlation coefficients indicated weak to no correlation between the three measures of students' performance in online environment and the two categories of measures of student-expert conceptual closeness.

A significant number of correlations had also reversed signs as compared to the researcher's expectations. That is, positive correlations were found between performance and hamming distance, and negative correlations were found between performance and structural correlation.

These results suggest a poor alignment between the two categories of measurements associated with students' learning of biblical criticism. On the other hand, the weak correlations between the two sets of measures suggest that they mainly explain different portions of the variance associated with students' learning of biblical criticism.

6.3.1.3 Summary of Findings

Overall, the results from the analysis of the closeness between students and expert conceptual networks showed that when required to recognize associations among concepts in a given set used in the biblical criticism methods, students' conceptual networks were significantly closer to expert's network than when students were required to analyze a gospel passage.

Both metrics used for this analysis, the hamming distance and the structural correlations between students and expert conceptual networks revealed the same trend. However, the analysis of the structural correlations indicated stronger discrepancies between the conceptual networks that were elicited in the free concept association task and respectively in the gospel interpretation task.

These results suggest, once more, that there is a gap between students' ability to recognize and to represent their conceptual structures associated with biblical criticism methods that may be approached in future stages of the Design-Based Research process.

The criticism method used in the exit interview was the only category in the student's diversity descriptors considered in this study that revealed a significant difference with respect of both measures of the closeness between students and expert conceptual structures, *but only for* the near-transfer tasks that required students to analyze gospel texts. All other measures of students' diversity, educational level, major, and epistemic beliefs, failed to reveal significant differences with respect of the two measures of the closeness between students and expert conceptual networks.

A weak to no correlation was found between the three measures of students' performance in online environment and the two categories of measures of students' conceptual closeness to the expert. This result suggests that the two categories of measures mainly explain different portions of the variance associated with students' learning of biblical criticism. Also, the significant number of correlations that were found reversed as compared to expectations suggests a poor alignment between the two categories of measurements.

6.3.2 Qualitative Aspects of Students' Conceptual Understanding of Biblical Criticism Methods

Quantitative analysis of students' conceptual networks offered a first important, yet partial perspective on the quality of students' conceptual understanding of biblical criticism, or the lack of it. The statistics behind the artifacts produced by the students were a good indicator of *what* was different in students' ability to map expert's conceptual patterns associated with various biblical criticism tasks. To increase the depth of the analysis, potential answers to *why* students built such a range of conceptual patterns were sought.

The main focus was on identifying qualitative aspects that could help the understanding of why students succeeded or failed to integrate concepts from biblical criticism methods in their conceptual framework. The qualitative analysis was built on: a) students' artifacts produced while applying biblical criticism methods to gospel texts, and c) the general use of methods-related concepts when students answered open-ended questions related to their own perception of religious studies.

6.3.2.1 Data Analysis

The quality of students' conceptual networks reflected in the use of methods-related concepts, or the lack of it manifested as trends in building misconceptions and over-simplifications, were analyzed.

To analyze the concept maps produced by the students while applying biblical criticism methods as part of the near-transfer task in the exit interview, all maps were printed and then compared. The quality of the concepts used by the students in building their maps was assessed by using the instructor's grouping of students' concepts in equivalent student-instructor groups. The procedure to generate these groups was described in Chapter 6.1.3.5. The structure of the links among concepts in students' maps was then analyzed to identify patterns that either supported the quality of the conceptual structure or indicated trends in building oversimplified conceptual patterns.

Next, students' answers to the open-ended questions in the exit interview were analyzed using an analytical induction methodology. Analytical induction provided an ideal methodology for identifying themes and categories associated with the quality of students' conceptual networks.

A first initial open coding process allowed the researcher to get familiar with the content and generate a series of free codes that formed the base for the next step, the axial coding that reduced the first set of codes by merging similar codes and reassigning codes to particular text elements. The codes were then grouped in themes and the student's use of conceptual patterns associated with the four criticism methods identified in students' answers for each identified theme. Similarities and differences between participants in this case study were then identified and reported.

6.3.2.2 Results and Interpretation

Research Question 5: After being exposed to the instructional process that includes Daily Intelligencer, to what degree students' use of concepts associated with biblical criticism methods: a) supports the quality of their structural networks; and b) reveals trends in building misconceptions and over-simplifications of knowledge?

6.3.2.2.1 Qualitative aspects of students' understanding of biblical criticism methods reflected in the concept maps they produced while analyzing gospel texts. The visual inspection of the concept maps that students produced for the same gospel texts revealed two major qualitative indicators: a) the nature of the concepts used in building of the concept map; and b) the structure of the links among these concepts.

Despite the fact that all students and the expert used the same methods and the same gospel texts, the fluidity of analysis in biblical criticism allowed for a wide range of acceptable pieces of evidence to support each method-based position. That's why the concept maps resulted from students' analyses of the same gospel texts, with the same method, included a wide range of concepts.

The instructor's grouping of students' concepts, initially used to build the expanded expert maps used in the analysis of the closeness between students' and expert's conceptual structures (Appendix J) offered a first image of the nature of concepts students used in their maps. First, the use of concepts across the four methods of biblical criticism analysis of gospel texts indicated students' tendency to build sequences of factual concepts, taken directly from the analyzed texts. The expert, on the other hand, built sequences of concepts that synthesized the facts in the text at a more abstract level. For example in the feminist interpretation, to describe one of the factors that is an indicator of the role the analyzed text has on liberating women the instructor used the following sequence: "*gender imagery* → *woman breaks stereotypes by asserting herself* → *Jesus shifts from male detachment to changing his mind*". The most common equivalent concepts used by the students in the feminist group for the same part of the analysis were actual descriptors of the woman's attitude. These descriptors varied from more synthetic expressions such as "*woman as unclean*", "*woman is humble*", or "*woman appears weak*" to a more factual description from the text such as "*She bows down at his feet implicating his higher authority*".

For historical criticism method, the one for which student's conceptual networks were found to be, on average, the closest to the expert's conceptual network, the sequences of concepts used in the analysis included several instances that mapped the instructor's ones. For example the instructor used the sequence: "*embarrassment* → *Jesus loses argument to a woman*".

Students' interchangeable sequences found in the historical criticism group were: "*embarrassment → Jesus admitting questioner as correct*", "*embarrassment → it would have been embarrassing for Christians to see Jesus lose this argument*", and "*embarrassment → the woman questioning and changing Jesus' mind*". However, majority of the concept sequences used by the students for this part of the analysis included factual concepts. They varied from:

a) Sequences equivalent with the instructor's one: "*embarrassment → Jesus questioned by woman*", to

b) Sequences considered as acceptable replacements by the instructor, such as: "*embarrassment → Jesus and disciples refuse to help woman*", "*embarrassment → Jesus and disciples refuse to help woman - causes church embarrassment*", "*embarrassment → woman seems more wise than the disciples*", and "*embarrassment → woman doesn't identify Jesus as Son of David*".

In contrast, for the redaction criticism method where the student's conceptual networks were found to be, on average, the furthest from the expert's conceptual network, students generated sequences of concepts with no validity for this method.

The main category of invalid sequences was related to the lack of understanding of the purpose of the analysis for this method. That is, redaction criticism requires the interpreter to analyze the additions, deletions, and modification made by the redactor to a source text. Three of the students in this group included in their concept maps a sequence of similarities between the two texts, which indicated a very low level of understanding of this method.

These three sequences were: “*Same → it is not fair to throw the children’s food to the dogs*”, “*Same → Tyre/ woman begs for Jesus to cast out demon/ Jesus say line about children/ woman rebuts/ Jesus commends her faith/ child is healed*”, and “*Similarities→ mentions Tyre/ Jesus heals the woman’s daughter as a consequence of her response*”.

The other sequences of concepts considered invalid by the instructor for this method included: a) personal opinions not supported by the analyzed texts, “*Mark → purpose of the healing is to get rid of the woman*”; and b) facts with no significance for the role of the redactor in the given texts such as: “*woman was a gentile*”, “*richer audiences*”, or “*O[ld]T[estament] symbolism: children, sheep*”.

The structure of the links among concepts was the other quality indicator of students’ conceptual structures. The expert built his maps using a well organized hierarchical structure of links that clearly depicted the elements of the method used and the evidence that the text offered to support each element. Appendix J presents all four method-related maps built by the instructor. In contrast, the majority of students’ concept maps had a significant number of redundant links to concepts representing the author of the text. Figures 6.12 to 6.15 show examples of maps for each of the four biblical criticism methods used by the students during the exit interview.

In these maps the redundant links, when present, were marked with a dashed elliptical area by the researcher. In addition to the redundant links to the author of the text, in some cases even the concepts representing elements in the analysis for the biblical criticism method used were linked to the concept representing the author of the text instead to the concept representing the criticism method.

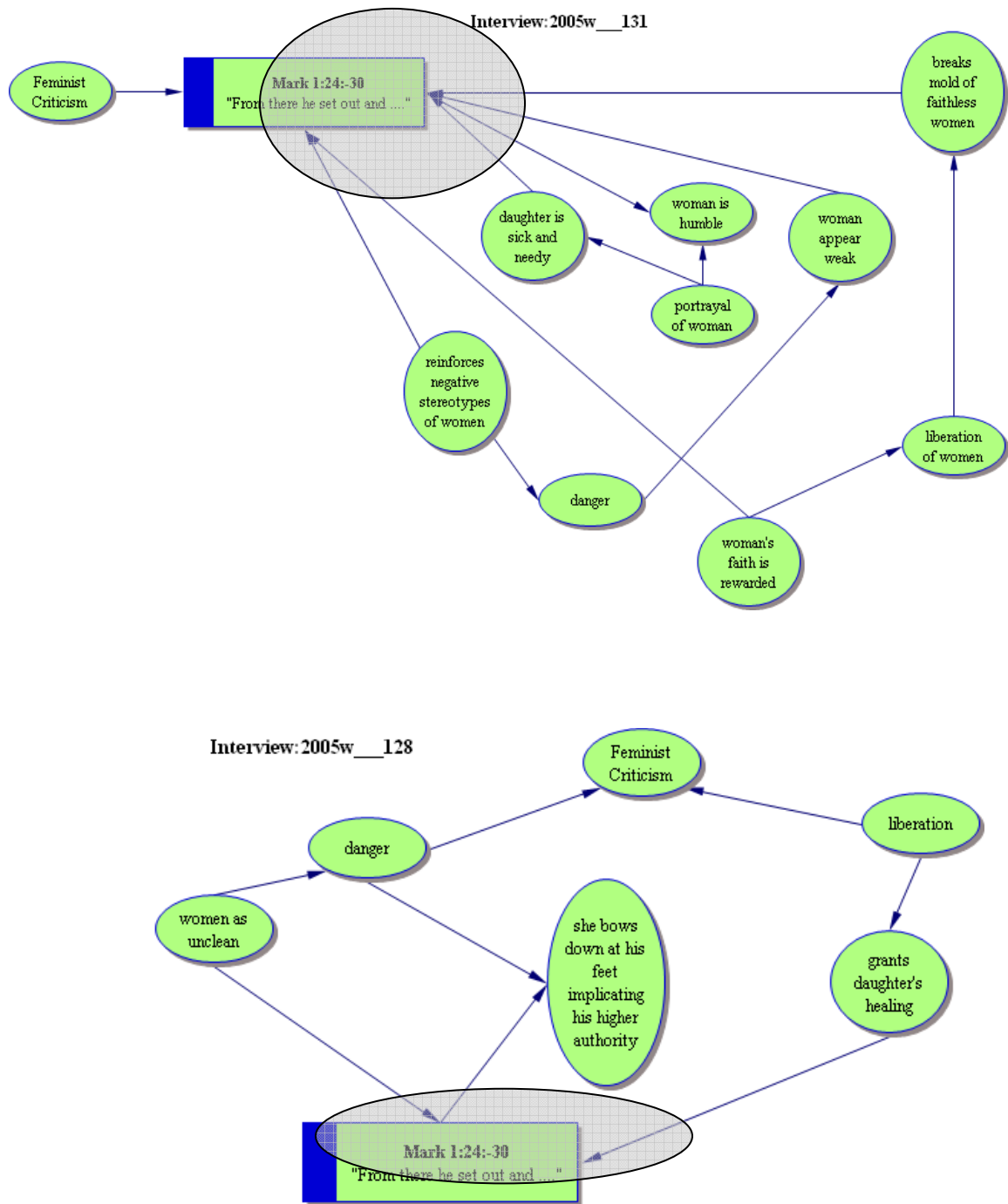


Figure 6.12 Examples of link patterns for maps from *feminist interpretation* group

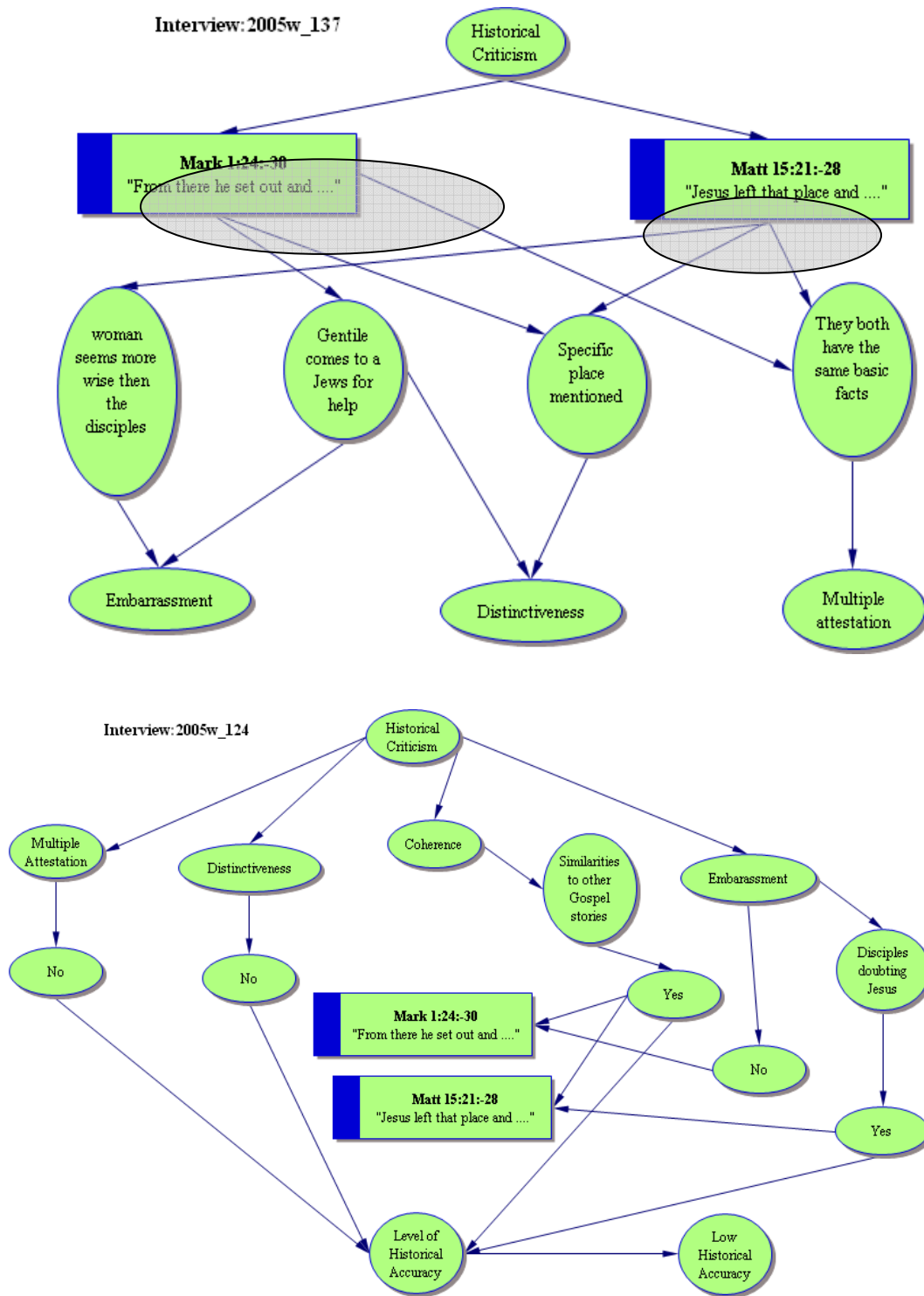


Figure 6.13 Examples of links patterns for maps from *historical criticism* group

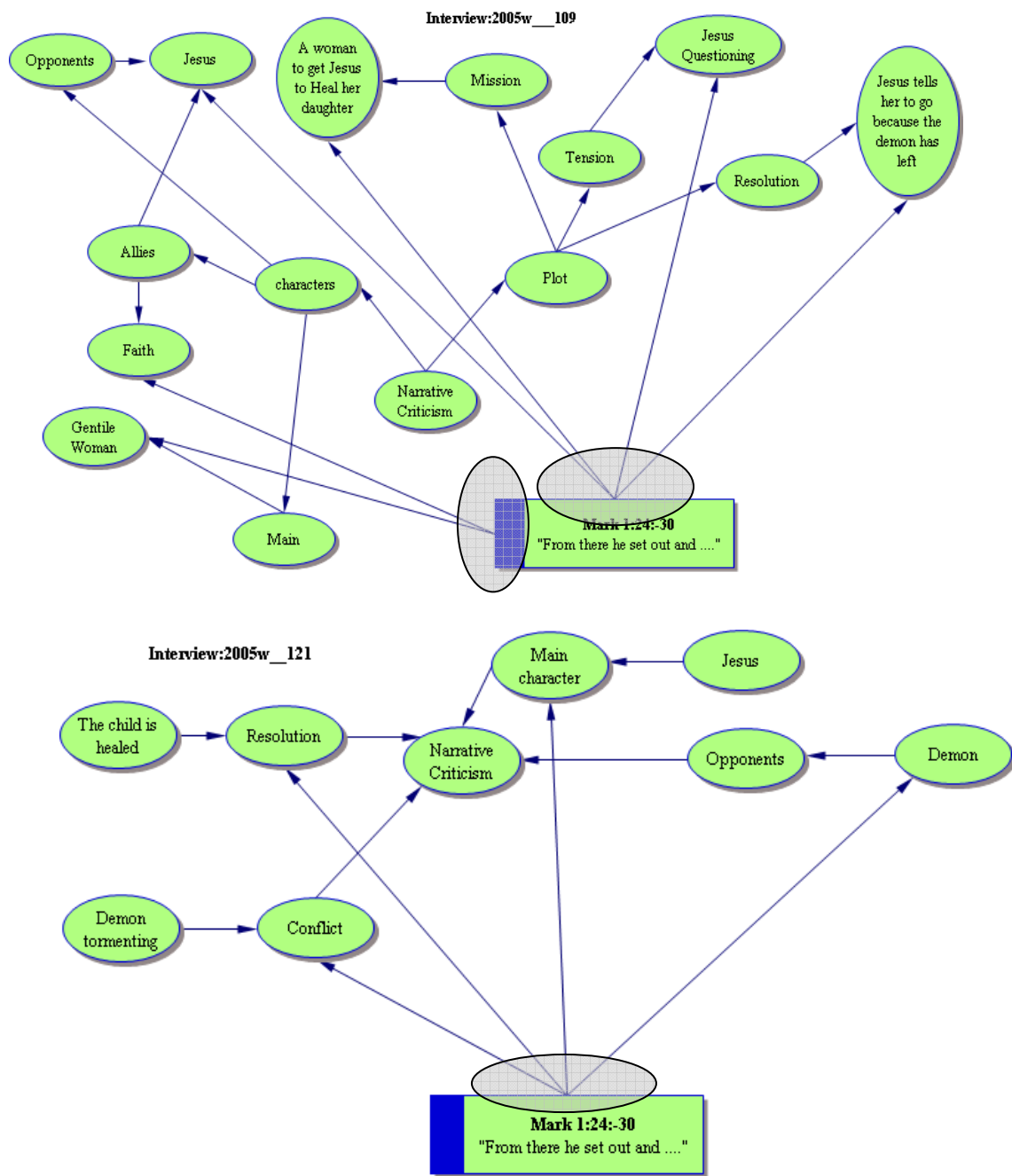


Figure 6.14 Examples of links patterns for maps from *narrative criticism* group.

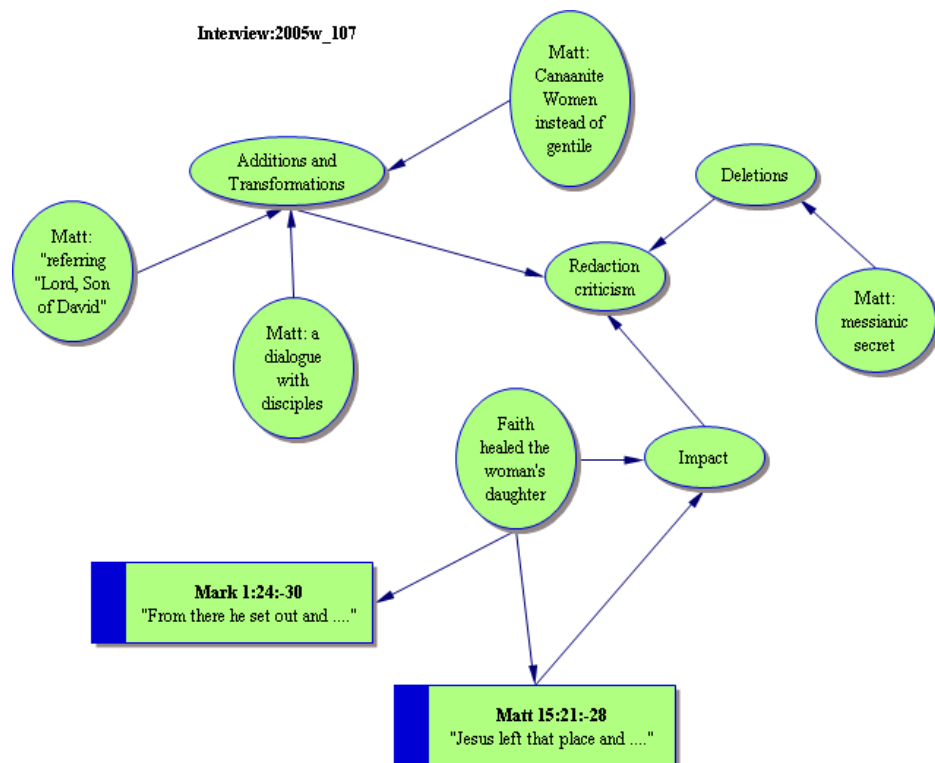
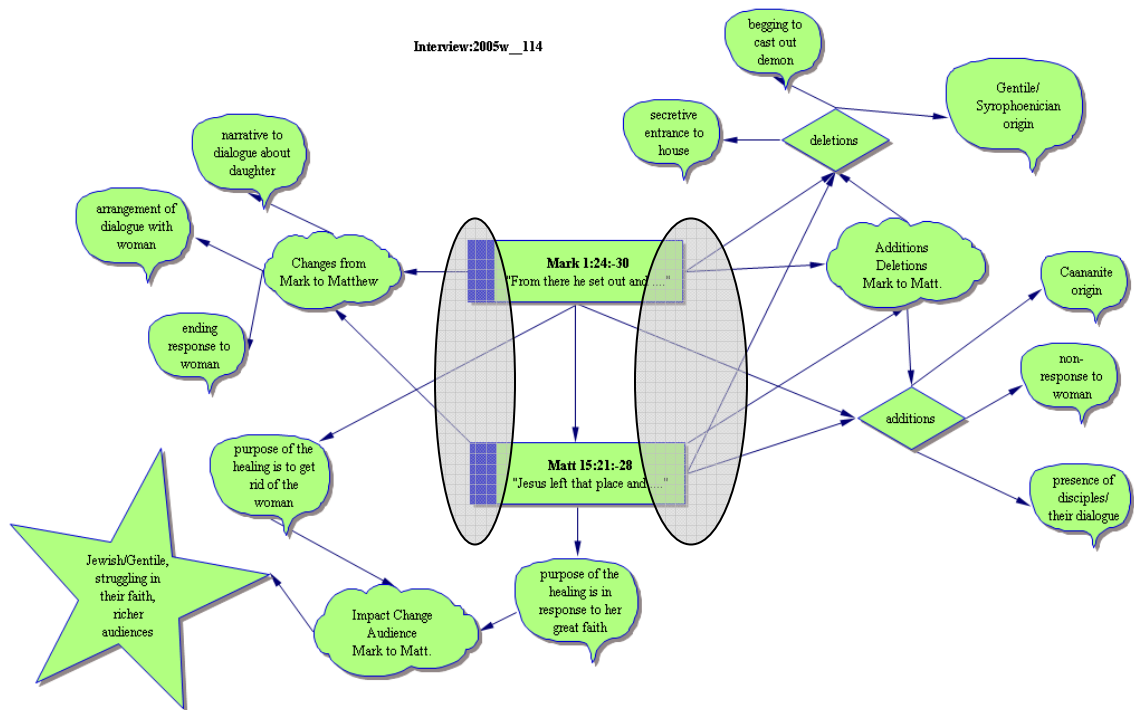


Figure 6.15 Examples of links patterns for maps from *redaction criticism* group.

For example, in Figure 6.12 for the map built by the student 31 (Interview 2005w_131), concepts such as “*danger*”, “*liberation of women*”, and “*portrayal of woman*” were linked to concept representing the author, “*Mark 1:24:-30*”, rather than to the concept symbolizing the method. Similar patterns were found for student 14 in redaction criticism group (see Figure 6.15, interview 2005w_137), and respectively for student 37 in historical criticism group (see Figure 6.13, interview 2005w_137). Out of the 38 maps built by the students, only in two instances, for student 24 in historical interpretation group (Figure 6.13, interview 2005w_124) and respectively for student 7 in redaction criticism group (Figure 6.15, interview 2005w_107), the patterns of links to the author of the text were not redundant.

To conclude, both the use of factual concepts and the tendency to produce redundant links to the authors of the analyzed text indicated that students relied on the text to develop their analysis and to develop the maps associated with it. In contrast, the instructor’s maps indicate that experts use the main elements of the method to synthesize the information in the analyzed text and when proper factual concepts provided evidence to support the analysis. Students’ tendency to rely on textual cues when conducting their biblical criticism analysis is then one of the factors that negatively influenced the quality of their conceptual structures.

6.3.2.2.2. Evidence of use of biblical criticism concepts in students’ answers to open-ended questions related to their perception of religious studies. To expand the analysis of students’ conceptual structures beyond the use of biblical criticism concepts in method-related tasks, their answers to two open-ended questions from the exit interview were analyzed.

The first open-ended question considered for this study asked students to define religious studies and then prompted them to clarify if, in their opinion, the same definition applies to both academic and non-academic settings.

The second open-ended question considered for this study asked students to indicate to what degree their understanding of religious studies changed after the gospel part of their course (see Appendix H). Two major themes that reflected the level of integration of biblical criticism ontology resulted from the students' answers to the first open-ended question: a) religion studies as academic field of study; and b) religion studies as both academic and non-academic field of study.

Students that defined religious studies as academic field of study without prompting from the researcher made a clear distinction between beliefs and academic interpretation. Also they maintained their position when prompted to clarify their perception with respect to the non-academic perspective of religious studies. The answers of students that hold an academic view of religious studies varied content wise from explicit inclusion of concepts associated to biblical criticism methods to a more implicit reference to the biblical criticism field. For example student 21 defined religions studies as follows (researcher's emphasis in italics):

Student 21:

R: I would say that it's [religion studies is] a *study of religious documents, history, background and like* with what we're doing in this class, actually studying the different ways of studying religion, *with the different criticisms* and all those kinds of things. So I think it's kind of a broad term, because you could be studying a variety of different things within the genre of talking about religion (Paragraph 18, 381 characters, interview 2005w_121).

When prompted to discuss about the non-academic definition of religious studies, student's position was the same and again augmented with concepts from biblical criticism:

Student 21:

R: I know with, like when you're talking within the realm of the church, I think it's definitely more to get a spiritual belief out of it. And I think with this class it's definitely more that you're looking at the academic, the *scholarly study* of it, where it's more ... we're looking at *more factual things*. We're talking more about the *writers of the different parts*, so it seems to be more of a *fact-driven* ... more so than when you're talking in church and that kind of area. It might be more of somewhat faith and what Scriptures are saying instead of, *in this class*, it's kind of like you're looking at *why did they change this?* Or *why did they say this?* (paragraph 22, 659 characters, interview 2005w_121).

Similar, but less descriptive perspectives on the definition of religious studies was also found in the answers provided by students 22 and 31(second answer indicates respondent's answer to researcher's prompt on non-academic perspective):

Student 22:

R: Um, I think it's just looking at the Bible and the texts from an academic point of view, not bringing personal beliefs into it so that's really neat to me, and it's just *delving deeper into the text* and just, like morals and messages and that kind of thing (Paragraph 24, 257 characters). [..]

R: You *just look straight at the text* (paragraph 32, 35 characters, interview 2005w_122).

Student 31:

R: And now we're taught to like think about it, like think about it differently, like... *Just like the feminist ways* [..]. Like, I never thought about the gospels in that way before. We've never been taught that. We've always been taught: this is how it is, this is what happens. I love it, I love thinking of it in a whole different way. I think it's more broad (Paragraph 20, 359 characters).

R: I think more academic is more *like studying the facts*. Like, this is what happened. Or [] all the time. And I think the other, like the other nonacademic part would be more like your personal. Like, when you bring in your view to it and like you open that up (paragraph 36, 262 characters, interview 2005w_131).

Most of the students interviewed for this study hold a dual model of religious studies, both academic and non-academic. The academic religious studies were seen as more objective and/or fact based as compared to the non-academic religious studies.

The presence of biblical criticism concepts in these dual models varied widely from:

a) some presence of explicit concepts associated with biblical criticism methods:

Student 5:

R: It seems like it's the same, but at the same time there are some differences because if you take, in the class, like I said, I'm *learning a lot more about the text*, going into detail, *comparing text*, *pulling certain things out of text*, who said what, how they said it, *learning about the authors* and how their way of writing and *how they were talking to different communities*. I had no idea about that. So that's what makes a different from an academic view versus if you're just in a church setting, where you go to church and the pastor takes a Scripture and begins to preach off that Scripture. You don't get things like the author of this book and the reason why he wrote it because of this. You don't get all that (paragraph 38, 721 characters, interview 2005w_105).

Student 16:

R: I think that an academic perspective is usually a lot *more objective*. A lot *more focused* on, here's what happened. It's *open for interpretation*, but we're going to *talk about why it happened*, or *what happened*. But as far as like from a religious perspective, it would be angled more towards what "this is what we believe. Here's what backs it up, but this is how we interpret it." More interpretation, probably (paragraph 26, 412 characters, interview 2005w_116)

b) to a more implicit inclusion of some conceptual structures associated with biblical criticism:

Student 24:

R: I think there's definitely the *historical element* of how everything came to be along the two thousand years from what everything's being written from, and earlier than that with the Old Testament. And I think there's also the biased perspective, where you can actually be not analyzing but looking into the material for guidance to where you get your morals and values from it also. So, I think there's *definitely two different aspects* (paragraph 24, 437 characters, interview 2005w_124).

Student 6:

R: Yes, there is a big difference. Like, dealing with, say, in a secular school, like the university is, they take a different outlook on religion than you would get studying religion by going to the churches or synagogues or places where they actually teach the religion, because there is more of a biased look on it. It's saying, this is the truth and this is our truth. But coming to university and studying it, it's *not looked at as a specific truth but as facts*. And *you can look at from a different perspective* (paragraph 24, 514 characters, interview 2005w_106).

Student 31:

R: I think more academic is more like *studying the facts*. Like, this is what happened. Or [...] all the time. And I think the other, like the other nonacademic part would be more like your personal... Like, when you bring in your view to it and like you open that up (paragraph 36, 262 characters, interview 2005w_131).

Student 32:

R: [...] whereas with an academic setting, it's more... *you're trying to get the facts*. Maybe not apply them to your personal life, *just the information about it*. Whereas I think in a religious setting, it's more that kind of enlightenment or enrichment (paragraph 32, 246 characters, interview 2005w_132).

Student 15:

I think *academic studies* are more like *focused on researching and finding out what's going on*, and in a non-academic setting you're putting force on you to have like a setting, an opinion. It might be religious, Christian or Catholic (paragraph 22, 235 characters, interview 2005w_115).

Student 25:

R: That's tough to say because it's so hard to say what an actual religion is these days with all the different belief structures that are out there. So, I guess I would define it right now as just like, just *like a more objective look or analysis* of a belief structure that has been established in some way with either so many people believing in it or something. Just because there's so many different kinds, it's so hard to say what a religion is (paragraph 20, 447 characters, interview 2005w_125).

Student 2:

R: Like as being secular and as the Bible, *just like a text*, and *we're analyzing it*. Whereas in like seminary school you accept it as the truth (paragraph 24, 142 characters. Interview 2005w_102).

c) to very poorly justified perspectives on religious studies.

Student 14:

R: I think that inside the school it's just another class, and outside the school it's kind of like religion classes, you're really into that, I guess (paragraph 32, 148 characters, interview 2005w_114).

Student 26:

R: That's broad. I would say just the study of different cultures and their traditions and what they hold... where they place their importance in values, and ethics, and different belief systems. And then how that's carried through, whether that be through traditions and language, and relationships and stuff like that (paragraph 28, 318 characters, interview 2005w_126).

The second open-ended question asked students to indicate to what degree their understanding of religious studies changed after the gospel part of their course. Students' answers to this second, more reflective question were generated two main themes: a) gained a different perspective on religious studies; and b) got a better understanding of religion studies.

The first theme revealed more generic use of conceptual structures associated with biblical criticism. Concepts used in this case had no strong link to one of the four methods used in the gospel part of the course. Answers from students 2, 8, 19 and 22 were found illustrative for this category.

Student 2:

R: I've always grown up in a Christian home, I've always read the Bible and accepted it. And we didn't analyze it. Analyzing it has made me realize there's a lot more in it. [...] now when I read the Bible *I analyze it and I have the different critiques and stuff*. Which is really weird (paragraph 38, 228 characters, interview 2005w_102).

Student 8:

R: I guess, personally, I didn't know that there were *different groups* around that time that were *all vying for power*. That kind of [long pause]. Well, that may have impacted my understanding a little bit because [long pause]. It's almost like *everyone is trying to tell their version of the story* (paragraph 52, 295 characters interview 2005w_108).

Student 19:

R: I can see that a lot more now when I talk to people about religion, that they ... it's not necessarily a bad thing because so much religion is based on it doesn't matter. You know, we've got these books ... it really doesn't even matter, when it comes right down to it, where they came from. But it just kind *sort of strengthens your argument when you talk to other people*. So that kind of changed. I didn't realize how much people don't know, sometimes, about their religion (paragraph 62, 472 characters, interview 119).

Student 22:

R: I learned a lot from the Reddish book and we're just like *realizing all the differences between the gospels*, and before I definitely kind of melded them all together [...] (paragraph 40, 166 characters)

R: More like an intellectual level instead of just being like a, you know, with the feel-good message of the Bible. *Now I can study it and compare the two* and just kind of *think about the authors more* (paragraph 52, 198 characters, interview 2005w_122).

In contrast, the students that focused on gains in understanding of religious studies used more often specific biblical criticism concepts and conceptual structure. Concepts used in redaction criticism (e.g. deletions, modifications, social settings), historical criticism (e.g. multiple attestations), and narrative criticism (e.g. characters, play) were clearly stated in students' answers.

Student 5:

R: What changed for me was that I didn't know that the passages ... like, I knew that some of the stories were similar in the gospel, but *I didn't realize how things were deleted, taken out and modified*. I didn't realize that. And at first it kind of threw me, kind of confused me. But then I took it back to where I was like, *whoever the authors are, they're talking to different communities of people*. So it's not that it's contradicting, it's just that it's going towards different audiences. And that helped me out a lot because it's like, "ok, is this contradictory?" I know this isn't contradictory. So when I went back, I was like, ok, *it's going towards different audiences*. It's not contradictory. It's *just their perspective* of this particular story (paragraph 66, 756 characters, interview 2005w_105).

Student 6:

R: Until now I didn't understand how you really are supposed to look at the Scripture and *how* during those time periods *history was recorded*, and how they lived their life, and *how much oral traditions affected everything*. And I didn't understand the reason why there were four gospels when one says the same thing as the others. But looking at it as *having multiple attestations* is a good thing. And so I really, it really greatly improved my understanding of how the gospels were written (paragraph 32, 487 characters, interview 2005w_106).

Student 7:

R: Just, for instance, how, like the *authors' social setting* can affect *what and how they wrote what they did*. And then just also the fact that the authors of the gospels is really ... we don't really know, because I would have this kind of naïve outlook, oh, *Mark really did write the gospel of Mark*, and it really may not have been that person (paragraph 28, 343 characters, interview 2005w_107).

Student 18:

R: I think a number of things we already learned I had no idea there were so many different ways to look at the gospels, especially in *how characters play against each other* and everybody has a different opinion on how things happen and I had no idea there was such a vast way of looking at it (paragraph 20, 291 characters, interview 2005w_118).

Student 33:

R: [...] I'm more aware of what the actual Bible says, especially the gospels. I'm a lot more aware of *where each of the authors is coming from*, the history of it, a little bit of a background. Just *their main point* and what they're trying... like, who they're writing to, *I never really thought about there being a certain audience*. You know, I basically just kind of thought, well this is a battle, this is what it said and we should follow it. You know. So it's been really interesting to *see just the different points that each one of the gospels is trying to make* or what they're trying to express, and the important aspects up there each time, too (Paragraph 64, 726 characters, interview 2005w_133).

Another group of students that focused on their gains in understanding mixed conceptual structures from more than one method in their answers.

Their use of method-specific concepts is still superior to their colleagues that reported a change a perspective. The following excerpts from students' answers illustrative for this category:

Student 1:

R: it's [change is] just in how in ... understanding, I think specifically with the different gospels, *like, what the audience is*. Even though *who the audience is*, say, now if you were Mark, may not change the meaning of the text, it just helps me *better understand why* they're saying those specific things (paragraph 48, 297 characters, interview 2005w_101).

Student 17:

R: [...] well, I never knew ... let's take the gospel of Mark or the gospel of Matthew, I never knew any back story to it, any history of well, *Mark probably was written first* [] Matthew, and *Mark was written to these people*. Here's what was going on at the time (paragraph 52, 256 characters, interview 2005w_117).

Student 23:

R: I think that, especially after the gospel portion of the class, I'm better able to *analyze the text and look at them deeper* in a more critical way and not, you know, not just read it and be like, "Oh, well, that's nice." You know, but be able to analyze it and be like, "*What exactly does this mean?*" Or, you know.. there was a couple of points I was like, "Well, you know, I never thought of it that way." You *never really think of the differences until you compare and analyze them* and break them down. And, so I think that's probably what's... (paragraph 58, 548 characters, interview 123)

Student 25:

R: [...] it's [the gospel part of the course] just caused me to look at something that I've just, like, read very casually and not thought about much in depth, and, like, how this came into being. To just thinking about, how did this come in to being? *Who copied off of who?* What happened when they were writing this that caused them to write it this way? So, it's just stuff like that I would have never thought about before. I mean, I thought about, *Jesus and mainly focused on him and his character*, and what he did, and believing in him before, when I read... Now I'm looking at it like I would look at, if I was reading, I don't know, *Pride and Prejudice*. Actually *looking at it as a literary piece* (paragraph 40, 663 characters, interview 2005w_125).

In addition, a couple of generic answers that failed to use specific concepts associated with biblical criticism methods were found.

Student 20:

R: I just have a better understanding of where it's coming from, who's involved, what comes next, and just have a basic history and understanding of where this text is coming from (paragraph 56, 177 characters, interview 2005w_120).

Student 21:

R: This class has kind of been ... we're learning about the background of that time, and so maybe kind of deeper understanding also, overall for me, because you're seeing it from that perspective, and also maybe why the teachings are what they are (paragraph 42, 200 characters, interview 2005w_121).

Overall, answers to both open-ended questions provided evidence of use of biblical criticism concepts and/or conceptual structures in students' answers. Students' placement in one the four major themes found in this study was influenced by the specificity and descriptiveness of the biblical criticism concepts used by the students. Being more reflective in nature, the second open-ended question prompted several students to reflect more in-depth on the gains in their understanding of religious studies. From the answers provided by the students in this group some included concepts and conceptual sequences that were traceable to specific biblical criticism method (e.g. narrative, historical, redaction). The majority of students' answers across the two questions asked by the researcher indicated the use of generic or implicit conceptual structures from the biblical criticism. Instances of answers that failed to indicate any evidence of the use of conceptual structures from biblical criticism were found for both open-ended questions.

6.3.2.3 Summary of findings from the qualitative analysis

The qualitative findings from both the analysis of students' artifacts produced in a method-driven task and their answers to two open-ended questions provided: a) some support for the quality of students' structural networks; and b) evidence of trends in building over-simplified conceptual structures. Most of the findings across the two analyses pointed toward factors that support students' tendencies to build over-simplified conceptual structures.

From the analysis of students' concept maps, both the use of factual concepts and the use of redundant links to the author of the text indicated students' tendency to rely on the cues from the text to conduct the analysis. Students' tendency to rely on textual cues when conducting their biblical criticism analysis seems to be one of the factors that negatively influence the quality of their conceptual structures. For two instances, one that indicated the existence of student-instructor interchangeable concept sequences and the other one that indicated patterns of non-redundant links, students from the historical criticism group departed from students' from the other three biblical criticism groups. This finding triangulated with the findings from the quantitative analysis of the closeness between students' and expert's conceptual networks (historical group had significantly lower mean distance between students' and expert's maps than those in the other tree criticism groups).

The findings from the analysis of students' answers to two open-ended questions related to their perception of religious studies showed a trend that is supporting the findings from the analysis of students' concept maps. That is, the majority of students' answers across the two questions indicated the use of generic or implicit conceptual structures from the biblical criticism. This finding sustains students' tendency to build oversimplified conceptual structures associated with the use of biblical criticism concepts. On the positive side, this part of the qualitative analysis found that, when reflecting on their gains in understanding from the gospel part of the course, some of the students used concepts that were part of specific biblical criticism method (e.g. narrative, historical, redaction).

6.4 Chapter Summary

Figure 6.16 synthesizes the main changes from the first to the second macro-cycle that provided the context and directed the structure of the research trajectory analyzed in this chapter. The results of three major groups of research questions were analyzed in this chapter. A first research question was related to students' performance in online activities. The assessment of the fit for a proposed measured variable path model indicated that out of four dependent variables included in the model one, the intern-task essay score associated with the first task students were engaged in, did not explain at a statistically significant level a part of the final scores' variance. One potential research questions to follow, as suggested by this analysis, is if a change of the nature of the task for the intern task to better align its outcome with the outcome from the staff-task will produce significant increase in the overall fit of the proposed model.

A second set of research questions analyzed the closeness between students' and expert's conceptual networks. Overall, the results from the analysis of the closeness between students' and expert's conceptual networks showed that when required to recognize associations among concepts in a given set used in the biblical criticism methods, students' conceptual networks were significantly closer to expert's network than when they were required to analyze a gospel passage. The criticism method used in the exit interview was the only category in the student's diversity descriptors in this study that revealed a significant difference with respect of both measures of the closeness between students' and expert conceptual structures. Students in the history criticism group were significantly closer to the expert with respect of their conceptual structure associated with the analysis of gospel texts, as compared to students in redaction group.

RESEARCH		DESIGN	
Structure of the first DBR macro-cycle			
<u>Research Trajectory:</u>		<u>Learning Trajectory:</u>	
<ul style="list-style-type: none">- repeated-measure design		<ul style="list-style-type: none">- Cinema Hermeneutica;	
<u>Limitations:</u>		<ul style="list-style-type: none">- Job metaphor: temporary position as movie reviewer to a specialized magazine;	
<ul style="list-style-type: none">- measurements outside the learning process;- global measures of learning		<u>Limitations:</u>	
		<ul style="list-style-type: none">- static design;	
Findings from the first DBR macro-cycle			
<u>Findings from Empirical Data:</u>		<u>Findings from Design Implementation:</u>	
<ul style="list-style-type: none">- significant increase of the means essays scores from pretest to posttest;- historical criticism groups scored significantly lower than other three groups;		<ul style="list-style-type: none">- lack of consistency between task and activity metaphors confused students;- students had problems tracking their progress throughout the learning tasks;	
Changes for the second DBR macro-cycle			
<u>Research Trajectory:</u>		<u>Learning Trajectory:</u>	
<ul style="list-style-type: none">- case study with mixed-methods design;		<ul style="list-style-type: none">- The Daily Intelligencer;- overarching metaphor: department of a virtual newspaper;- task metaphor: career building;	
<u>Structure of the Analysis:</u>		<u>Advantages:</u>	
<ul style="list-style-type: none">- analysis of students' performance in online activities: assessment of the fit of a model fit of a proposed measured variable path model;- analysis of closeness between students' and expert's conceptual networks;- qualitative aspects of students' conceptual understanding of biblical criticism methods;		<ul style="list-style-type: none">- consistency of metaphors;- dynamic structure that allowed self-monitoring tracking of student's progress in the environment;- tracking of students' performance outcomes;- data collection part of the instructional process;	
<u>Limitations:</u>		<u>Limitations:</u>	
<ul style="list-style-type: none">- the use of an exit interview to compensate for the virtual nature of students' activity in online environment limited the nature of the sample and its size;		<ul style="list-style-type: none">- no user-friendly management interface for the instructor;- minimal graphic design;	
RESEARCH		DESIGN	

Figure 6.16 Matrix of changes from the first to the second DBR macro-cycle.

Finally, the qualitative findings from both the analysis of students' artifacts produced in a method-driven task and their answers to two open-ended questions provided: a) some support for the quality of students' structural networks; and b) evidence of trends in building over-simplified conceptual structures. Most of the findings across the two analyses pointed toward factors that support students' tendencies to build over-simplified conceptual structures. On the positive side, this part of the qualitative analysis found that, when reflecting on their gains in understanding from the gospel part of the course, some of the students used concepts that were part of specific biblical criticism method (e.g. narrative, historical, redaction).

Chapter 7 will present a summary of the results and of the discussions. Additionally, limitations, implications for research, instruction, and further design will be discussed.

CHAPTER 7 SUMMARY OF RESULTS AND CONCLUSION

7.1 Overview

The purpose of this chapter is to present an overview of the study and a summary of the findings that were described in the previous chapters. This chapter also presents the limitations and implications of the study and suggestions for further research derived from the findings of this study.

7.2 Research Purpose

The overall purpose of this study was to investigate the interaction between the learning process and the design-based process by using a cognitive flexibility hypertext (CFH) implemented in a large undergraduate course as the object of research. The first major focus was on the impact the integration of a CFH had on students' learning. A second major focus was on the structure of the Design-Based Research (DBR) process and its impact on the design and implementation of the CFH.

In the context of the learning process, this study examined: a) the ability of a CFH to scaffold students' understanding and use of biblical criticism methods for analysis of gospel texts; and b) the differences in students' performance and conceptual understanding due to several individual diversity measures such as entry-level skills, epistemic beliefs, or major.

In the context of the DBR process, this study examined: a) the design evolution of the CFH as informed by empirical data collected from analysis of students' learning outcomes; and b) the constraints imposed by the design process on the evolution and quality of the research process.

The quality analysis of the DBR process is presented in this chapter as a synthesis of research findings and the researcher's experience from two consecutive implementations of the online learning environment.

7.3 Procedures

This study employed a two-layered procedural structure: a) a macro-level layer for the implementation of the DBR process; and b) a micro-level layer for the implementation of research methodologies associated with the analysis of students' learning.

From a macro-level, the study followed two DBR macro-cycles, each of them consisting of one theory-driven design/redesign stage and one empirical refinement stage. For the purpose of this study, the researcher was fully involved in the first empirical refinement stage, the second data-driven redesign stage, and the second empirical refinement stage respectively.

The micro-level layer unfolded within each of the two stages of empirical refinement which were developed and implemented for this study. For the first DBR macro-cycle, Cinema Hermeneutica was the cognitive flexibility hypertext that was used in the gospel section of the course. Data were collected from a convenience sample of 104 students using pretest and posttest essays administered online between January and March of 2004. Along with the pretest essay, demographics and students' answers to Epistemic Beliefs Inventory (EBI) items (Schraw, Bendixen, & Dunkle, 2002) were collected. After engaging in Cinema Hermeneutica, all participants spent the first week reviewing the four perspectives as part of a simulated training exercise for a part-time job. Once trained, students had the opportunity to choose one of the methods.

To ensure a uniform distribution of students across the four methods, a limited number of openings was set for each method. These openings were allocated on a first-come-first-served basis. Students engaged in the assigned tasks for their chosen method. For each of the four criticism methods, the first task was a non-gospel worked example followed by a non-gospel analysis of a self-selected movie. In the last step in the online activity, students assumed the role of a full-time job as a critic for a religious magazine. This activity required students to practice and refine their method-related analysis skills in the context of short passages extracted from Gospels texts. As a culminating activity, students wrote and submitted a formal long essay on a given Gospel text from the perspective of their selected criticism method. A formal in-class examination concluded the gospel section of the course. This included interpretation of a Gospel passage along with other assessment items based on the lecture and small-groups tasks.

For the second macro-cycle, The Daily Intelligencer, a redesigned version of the online learning environment was used. The integrated structure of metaphors in The Daily Intelligencer allowed the researcher to collect measures of student diversity using tasks that were part of the online learning activity. Both EBI questions and demographic questions were included in the virtual job application packages for the job openings offered by the virtual newspaper. Data were collected between January and March of 2005. Following the hiring interview that produced the entry-level essay, each student engaged in tasks specific to the biblical criticism method associated with the virtual job he or she selected.

The tasks and the associated artifacts for all online jobs included: a) a training session followed by an internship assignment that resulted in a short essay; b) a more in-depth presentation of the method followed by a staff writer assignment that resulted in a second short essay; c) an introduction to application of the chosen method to gospel interpretation using worked examples, followed by the major online assignment that resulted in an 800-word essay on given Gospel text(s), depending on the method; and d) an optional reflection paper that simulated a job evaluation for career advancement purposes. Once students completed all online tasks, an announcement was placed on both the Daily Intelligencer home page and on the WebCT main page letting students know about a possibility for earning extra points in the course. The requirement for earning these points was participation in a 45- to 60-minute exit interview in the week following students' midterm exam (the conclusion of the course's gospel section). The interview included four sections. Two consisted of open-ended questions. The other sections included a think-aloud protocol and required the use of a representational tool. Thirty-eight students and the instructor participated in the exit interview. Three software packages were used during the interview: a) C-Mapper was used by half of the students, randomly selected, to produce a semantic map based on a set of 36 concepts; b) Inspiration (version 7.5) was used to produce a semantic map from the same 36 concepts as in C-Mapper by the other half of the students, as well as a concept map associated with the interpretation of two gospel passages by all students; and c) netu2's mediaCam AV software was used to record participants' on-screen computer activity, along with audio, combining these elements into a single capture file. To analyze students' answers to the open-ended questions in the interview, NVivo 2.0 qualitative analysis software was used.

7.4 Summary of Results

In this section, a summary of results and interpretations thereof are presented for:

a) the learning process; b) the design process; and c) the Design-Based Process evolution and quality.

7.4.1 Summary of the Results from the Analyses of Students' Learning

The main research results and their interpretation for the first macro-cycles are summarized in Table 7.1.

7.4.1.1 Limitations

For the first macro-cycle, two main limitations were identified regarding the research on student's learning. The collection of research data that were outside the scope of assigned online learning activities introduced the opportunity for biased student responses, as students were rewarded with extra points based only on participating instead of on the quality of their participation.

The second limitation in the first DBR macro-cycle was the fact that the research trajectory allowed only for a global examination of the online learning environment's impact on student performance. The actual impact of the learning tasks associated with the method used by the students could only be inferred, rather than demonstrated, from the short-text interpretation skills measured in the first macro-cycle.

For the second macro-cycle, an important limitation was the small sample of participants and the fact that participation was voluntary. Reported findings from analyses of variance with respect to statistical significance, or lack thereof, should be treated with caution.

Table 7.1

Summary of Results from the Analysis of Students' Learning in the Two Macro-Cycles

Results	Interpretation
First Design-Based Research Macro-cycle	
The main effect indicated a <i>significant increase</i> of the mean essay scores for the first instructional segment, from pretest to posttest, when Cinema Hermeneutica was part of the instructional process;	The positive impact of the first instructional segment is strengthened when considering that the time span between posttest and delayed-posttest is twice the one between the pretest and posttest;
The second instructional segment, from posttest to delayed-posttest, that included only lectures and small-group discussions <i>failed</i> to show a significant increase of mean essay scores.	
The students in the historical criticism group scored significantly lower than those in any of the three components of the second group;	From the perspective of students' text interpretation skills, the structure of the activity for the historical criticism method appears to be less effective than the other three methods;
Epistemic beliefs and entry-level scores, the other two quantifiers of students' diversity, did not produce any interaction in time;	The fact that the instructional segment that included Cinema Hermeneutica primarily targeted the medium entry-level skills group signaled the potential for better learning scaffolds for students with both the high and low-entry level skills;
The medium entry-level skills group was the only one for which the mean scores increased significantly when Cinema Hermeneutica was part of the instructional process;	
Second Design-Based Research Macro-cycle	
For students' online activity, the entry-level essay score was a <i>statistically significant</i> predictor for the staff-task essay score and respectively the staff-task essay score was a <i>statistically significant</i> predictor both for gospel essay score and the reflection essay score;	
The intern-task essay score does not explain at a statistically significant level a part of the final scores' variance	The nature of the intern task was not aligned with that of the other three of tasks students were involved as part of their online activity;
When required to recognize associations among concepts from the set used in the biblical criticism methods, students' conceptual networks were <i>significantly closer</i> to the expert than when they were required to analyze a gospel passage.	The results suggest that a gap exists between students' ability to recognize their conceptual structures associated with biblical criticism methods and their ability to represent them.

Table 7.1 - continued

Summary of Results from the Analysis of Students' Learning in the Two Macro-Cycles

Results	Interpretation
Second Design-Based Research Macro-cycle - continuing	
The results from analysis of closeness between students' and expert's conceptual networks showed that, when required to recognize associations among concepts in a given set used in biblical criticism methods, students' conceptual networks were significantly closer to expert's networks than when students were required to analyze a gospel passage.	The results suggest the existence of a <i>gap</i> between students' ability to recognize and to represent their conceptual structures, as associated with biblical criticism methods.
Students in the history criticism group were <i>significantly closer</i> to the expert with respect to their conceptual structures associated with analysis of gospel texts, as compared to students in the redaction criticism group;	Considering the results from the first macro-cycle, these results suggest that the effort to <i>align the effectiveness of the online scaffolding for all four methods</i> produced a positive result in the current design
Pearson correlation coefficients indicated a <i>weak to no correlation</i> between the three measures of student performance in the online environment and the two categories of measures of student-expert conceptual closeness.	These results suggest a <i>poor alignment</i> between the two categories of measurements associated with students' learning of biblical criticism;
The use of factual concepts, as well as the use of redundant links, indicated students' tendency to rely on cues from the text to conduct the analysis;	Students' tendency to rely on textual cues when conducting their biblical criticism analysis seems to be one of the factors that negatively influenced the quality of their conceptual structures;
The majority of students' answers across the two questions indicated their use of generic or implicit conceptual structures from biblical criticism.	This finding sustains students' <i>tendency to build oversimplified conceptual structures</i> associated with the use of biblical criticism concepts.
On the positive side, this part of the qualitative analysis found that, when reflecting on their gains in understanding from the gospel part of the course, some of the students used <i>concepts that were part of specific biblical criticism methods</i> (e.g. narrative, historical, redaction).	

A second limitation for the second macro-cycle was related to the quality of concept maps generated by students in the exit interview during their analysis of the given gospel texts. The novelty of the concept mapping activity combined with the use of unfamiliar software, Inspiration, had the potential to bias the quality of students' output. Efforts were made to ensure each participant received the needed time to practice with the software before fully engaging in the actual task.

A third limitation for the second macro-cycle was related to the researcher's biases. The researcher's perceptions may have been influenced by prolonged engagement in a topic that is not in his area of specialization, which may have created a false sense of expertise. Measures were taken to reduce this bias. Instructor feedback was sought for issues related to biblical criticism. Also, when rubrics were used, the second rater involved in scoring of the essays was not familiar with the field of biblical criticism and/or the classroom environment for which the study was conducted. Therefore second rater's perspective was not biased by the direct involvement with the subject matter.

A fourth limitation of this study was due to its reliance on large, heterogeneous populations of undergraduate students enrolled in a general education course. Caution should be taken when attempting to use this online environment with more homogeneous student groups.

7.4.2 Summary of the Design of the Online Learning Environment

Design-Based Research builds on a very strong interdependence between the research and the design processes. However, the nature of design and its use in the learning process has a significant impact on the level of interdependence between design and research with respect to time.

Depending on the nature of a learning activity, a design can be refined at the micro-level (one month, or even one week sometimes), or at the macro-level (as long as one semester). For this study, because the activity was virtual and an integral part of the flow of the Gospel section of the course, refinement of the learning environment was made at the macro-cycle level. In this way it was possible to have a clearer demarcation between the research and design/redesign stages. The initial online learning environment that was fully integrated in the DBR process was Cinema Hermeneutica. From a design perspective, the major flaw of this first design was its poorly synchronized multi-layered set of metaphors: a temporary job as movie critic for four different magazines.

Research findings from the implementation of Cinema Hermeneutica suggested two major areas for potential improvements to the learning process. First, the scaffolds used for the four biblical criticism methods were not equivalent to each other in terms of their impact on students' learning outcomes. Second, the existing scaffolding helped students with medium entry-level skills significantly. Since one important characteristic of the population of students for which the environment was used was diversity of ages, entry-level skills, and education level, the need to reach the entire spectrum of needs associated with these characteristics was considered critical. Because of the time span between implementations (one semester), it was possible to allocate a good amount of time and resources to the redesign process. A group of master-level students enrolled in a biblical criticism course participated in the redesign process. The resulting redesign, The Daily Intelligencer, incorporated features that addressed most of the flaws identified in the Cinema Hermeneutica design.

The metaphors in the redesigned environment (a career with a virtual newspaper) were coherent across the activity as a whole and the associated instructional tasks. This alignment of metaphors allowed for creation of identical learning task structures for all four methods. In addition, the progression from low complexity to high complexity learning tasks: a) provided sufficient support for students with low entry-level skills; and b) created additional challenges in the learning tasks for students with high entry-level skills. The Daily Intelligencer also utilized a dynamic software architecture which allowed for the inclusion of a task completion monitoring structure in the environment. This feature helped students monitor their progress in the learning environment and provided instructors with information regarding all students' level of task completion. The main design limitations of The Daily Intelligencer were the lack of a user-friendly management interface for the instructor, and a minimalist graphical design.

7.4.3 The Design-Based Research (DBR) Process and its Quality

The immersion of the researcher in this study's DBR process for more than two years included: a) two refinements of the designed online environment; and b) two empirical research tasks that provided the data used to structure the two design refinements. The question still open at the end of that period was what makes the DBR process better than the more traditional approach of conducting two or more successive research studies for a given instructional design? What characteristics of the DBR process provide indicators on the quality of the outcomes? What quality indicators from current research practice (e.g. reliability, validity, or trustworthiness) might be transferred and/or adapted for DBR?

Clearly, the answers to these questions are well beyond the goal and scope of the current study; however, some reflections have emerged from researcher's extended immersion in the DBR process. These reflections are presented in the following paragraphs.

One characteristic of DBR that differentiates it from separate research and design sequences is its focus on the whole process of design rather than on artifacts that result from that design process. By focusing research on a developmental process (the design process), rather than on implementation of an artifact that is the result of that process, the research itself becomes a developmental process bounded by the affordances and the contextual constraints of the design process. In this study the initial research trajectory was a transitory one, as it was the design itself. During this transitory stage, design moved from the initial metaphor of Camp Hermeneutica to the new metaphor of Cinema Hermeneutica.

A positive aspect of DBR lies in the ability to also transfer characteristics of the research process to the design process. The need for coherence specific to the research process transferred to the design process during the redesign stage, when the findings from the previous empirical DBR refinement stage served as feedback for the next stage of the design process. The researcher's focus on aligning various measures of students' learning outcomes (e.g. entry-level, online non-gospel and Gospel essays) produced a more consistent set of design metaphors. A more consistent set of metaphors, in turn, allowed for the inclusion of the measurements of student's demographics and entry-level knowledge into the flow of students' online tasks.

This mechanism could be seen as the ability of a DBR process to connect interventions and outcomes through mechanisms that help align theory, treatment, and empirical measurements. This alignment is, in turn, a strong basis for *systemic validity* (Hoadley, 2004, p. 204).

Another major aspect that differentiates DBR from independent research and design activities is that the DBR process focuses on the whole context of the learning activity in which the artifact resulted. In contrast, independent research and design activities focus on the impact of an artifact, and consider the contextual learning activity as a precondition of learning and a constant for research purposes. On the other hand the fact that the DBR process focuses on the whole context of the learning activity generates one of the weaknesses of DBR. That is the DBR researcher has to find effective ways to report the research findings associated with complex, dynamic learning contexts. For this study, merely reporting the results from the first empirical refinement of Cinema Hermeneutica would be meaningless if the learning process were taken out of the context of its learning activity. The research results showing a significant increase of students' performance outcomes from pretest to posttest tell only one side of the whole story. The reader must bear in mind that these increased performance outcomes occurred while: a) the complexity of the learning process increased by exposing students to up to four biblical criticism methods with the help of the online learning environment designed and implemented for this purpose; and b) the instructional staff engaged in the process were the same as those engaged prior to introduction of the online component to the instructional process.

The two characteristics of the Design-Based Research (DBR) process discussed above alerted the researcher to the potential of looking at DBR as a culturally advanced form of developmental research (Figure 7.1), as proposed by Engestrom (Engestrom, 1987, 1999).

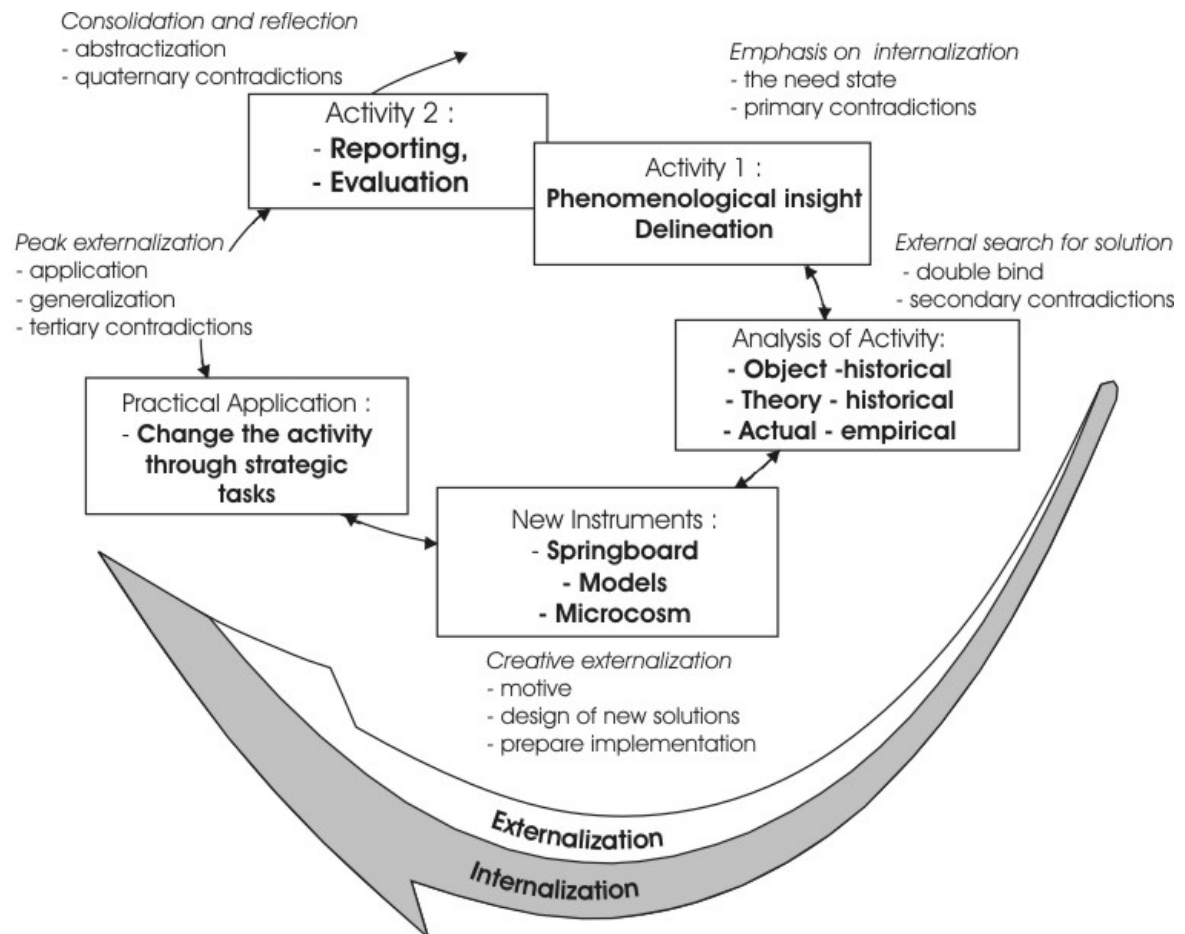


Figure 7.1 The methodological cycle of expansive developmental research. (Adapted from Engestrom, 1987, 1999)

The structure of Design-Based Research (DBR) reveals several critical elements that may help in qualifying DBR as a form of developmental research (Table 7.2)

Table 7.2

Characteristics of Design-Based Research as a Developmental Research Activity

Activity theoretical model of expansive developmental research	Design-Based Research as developmental research activity
A systemic approach of the developmental research that build on mediated tasks and actions.	Systemic link between design and research of technology-mediated classroom tasks and actions.
Focuses on generating culturally advanced forms of learning activities	Focuses on technology-rich learning activities that support deep learning
Uses contradictions as tools that drive the expansion of new forms of activity to emerge by comparing the transformative structure of the focal activity	Uses field-based implementation of a design to identify new learning trajectories that could offer better alternatives to support the instructional process
Transfers results and findings to the field of practice associated with the new form of activity	Generates evidence-based models of learning (local theories) that move the theoretical knowledge of the field forward

Future research could build on two major strengths of DBR as a form of the cycle of expansive developmental research (the expansive cycle) to address two of the major DBR quality issues. First, the expansive cycle proposes the model of activity as the unit of analysis, which helps the learning scientists to clearly *delineate the breath and the depth* of both the design and the research problem. Second, the expansive cycle proposes the use of activity contradictions as *drivers for both design and research trajectories*. For example, Barab et al. (2002) offered a comprehensive example on how the focus on contextual contradictions in the learning activity can improve the quality of the *research* process, while Jonassen (2000a) provided a very detailed account on how the activity theoretical perspective can improve the *design* process as a whole.

DBR can offer the opportunity to create synergy between these two perspectives with positive impact on the final outcome, the learning process.

7.5 Implications for Further Studies

This study identified several areas in which further research could provide additional insight into the complex nature of learning in the field of biblical criticism: designing online scaffolds for using cognitive flexibility hypertexts, and the Design-Based Research process.

7.5.1 Implication for Research of Learning in Biblical Criticism Field

First, this study proposed a series of expert-developed inquiry scaffolds for novice learners engaged in learning of biblical criticism methods applied to Gospel texts. This study focused on four methods that were considered complementary and also significant for novice learners, especially because they could be tied to both present-day activities and artifacts and to Gospel texts. There is still a need to investigate whether similar inquiry structures, used as learning scaffolds, will be effective for other biblical criticism methods which are currently used in the expanding field of biblical criticism.

Second, it will be interesting to expand the focus of research on the impact of the four scaffolds (feminist, redaction, narrative, and historical criticism) for texts other than Gospel narratives.

Finally, this study proposed a combination of tools and measures for understanding students' conceptual understanding of biblical criticism methods. The combination of quantitative and qualitative measures provided a more thorough picture of students' ability to map instructor's conceptual structures. More in-depth research is needed to define the optimal combinations of measures for conceptual structure quality.

Also of interest is how tools used to elicit conceptual structures (i.e., concept mapping tools) can be used to build effective learning scaffolds for the learning of biblical criticism methods.

7.5.2 Implication for Design of Cognitive Flexibility Hypertexts

This study proposed a structure for cognitive flexibility hypertexts that builds on the theoretical model of situated cognition for the development of design metaphors. This structuring of the online learning environment proved to be effective for novice learners, allowing for criss-crossing of the inquiry field specific to each biblical criticism method from two perspectives, and for a progression of learning task complexity within each of these crossings.

This study found that the alignment of the nature of scaffolding and the nature of the task associated with each crossing of the cognitive landscape can increase the overall impact of the environment on the learning outcomes. The current study used a combination of worked examples and reflective inquiry as scaffolds. Results indicated that, from a performance perspective, the worked example was not well aligned with the other types of scaffolds used. More research is needed with respect to the impact of this sequence, not only on performance but also on students' anxiety and confidence. An experimental design could shed some light on this late issue.

7.5.2 Implication for the Design-Based Research (DBR) Process

This study embedded the developments in DBR literature regarding the structure and the reporting of findings for a practical application of the DBR process into two consecutive macro-cycles.

Reporting followed the timeline of the process and included research reports on learning outcomes as well as narratives describing the design and redesign tasks. The virtual nature of students' learning activities specific to this study created both limitations and challenges for the implementation of the DBR process. While the research and design findings reported for the two consecutive macro-cycles represent in and of themselves significant contributions to the field of Design-Based Research, the researcher's reflective analysis found a potential theoretical link between the Design-Based Research process and the model of Research as Expansive Developmental Research as proposed by Activity Theory (Engestrom, 1987, 1999). Further conceptual and empirical research is needed to test this proposed link.

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the interviews
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APPENDIX A

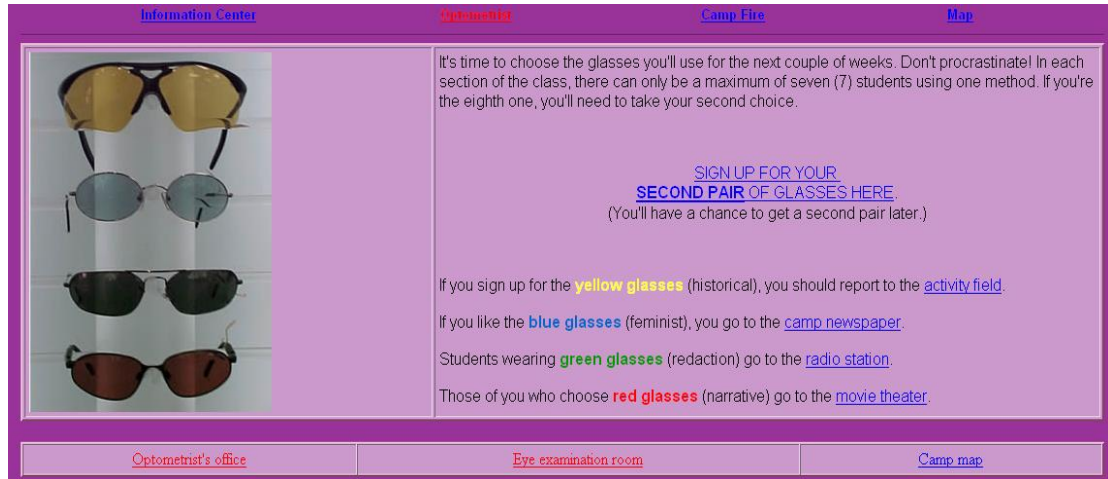
Camp Hermeneutica

Main metaphor: a summer camp with several activities and additional amenities.

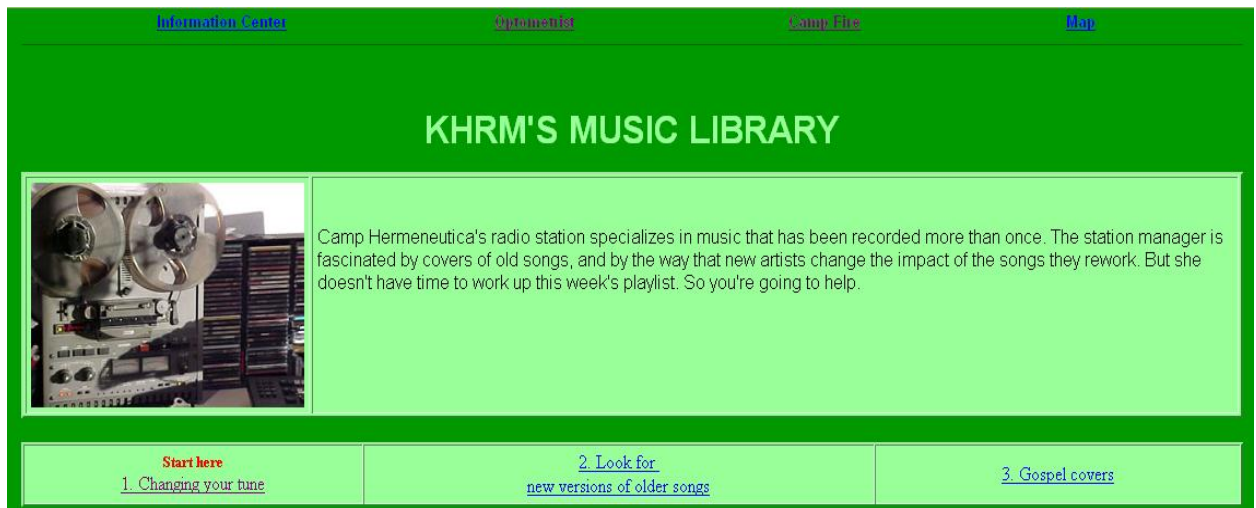
Having trouble seeing clearly? You better go to the **optometrist** right away.
In this camp, you can't see anything without glasses.

 Theater	 Information Center	 Camp Newspaper
 Optometrist's Office	 CAMP HERMENEUTICA	 Hall of Fame
 Activity Field	 Campfire	 Radio KHRM


Method selection metaphor: each pair of glasses offers a short guidance for a criticism method.



There were four *activity metaphors*, one for each of the four biblical criticism methods: a) Activity Field, for historical criticism; b) Camp Newspaper, for feminist interpretation; c) Radio Station, for redaction criticism; and d) Movie Theater, for narrative interpretation. Each of these activities included a series of two non-gospel tasks and one gospel task. As an example, the screenshots for redaction criticism, that is the Radio Station, are presented. The introductory screen presents the succession of the three major learning tasks.



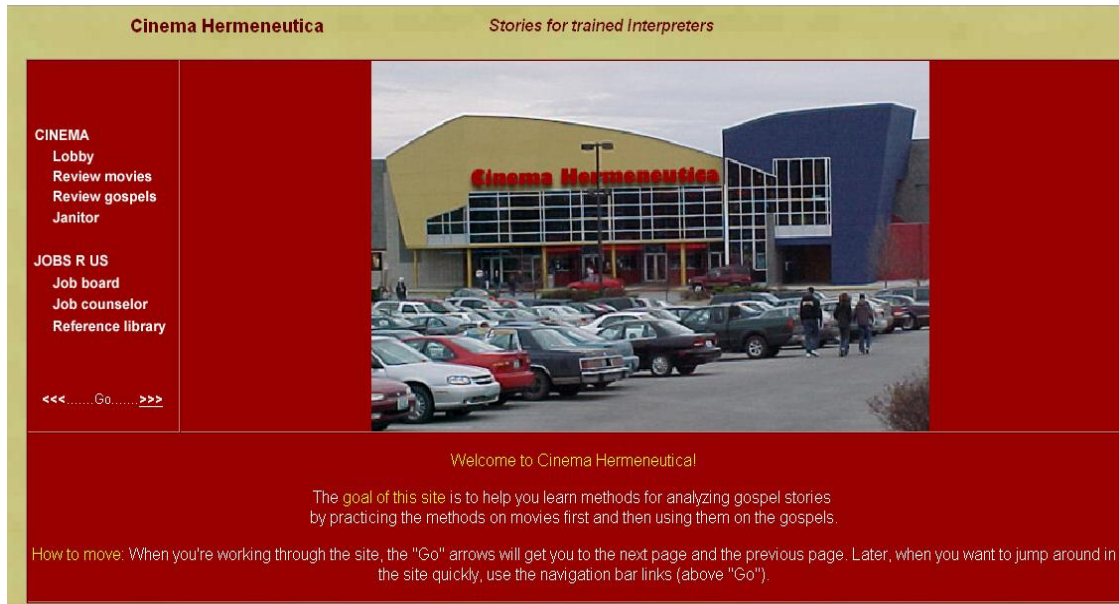
The Gospel covers presents students with a series of short gospel texts to practice the method-specific questions as they were developed by the expert.

Information Center	Discernment	Categorize	Map
<div><p>Here are some examples from the gospels for you to work on.</p></div> <div>EXAMPLES The death of Jesus, Luke 23:44-49 (Mark 15:33-39) A disturbance at the Jerusalem temple, Matthew 21:12-16 (Mark 11:15-19) Pilate sentences Jesus to death, Matthew 27:24-26 (Mark 15:15) Incident at Caesarea Philippi, Matthew 16:13-28 (Mark 8:27-9:1) Peter denies Jesus, Luke 22:56-62 (Mark 14:66-72)</div>			
<< Previous			Next >>

APPENDIX B

Cinema Hermeneutica

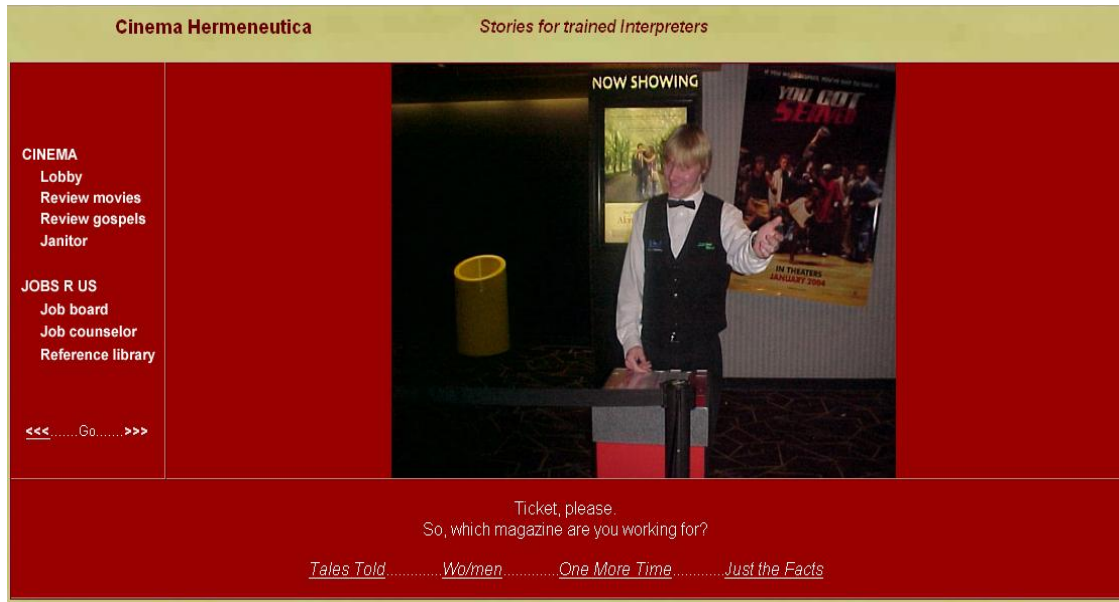
Main metaphor: a cinema theater that hires temporary critics for its associated magazines.



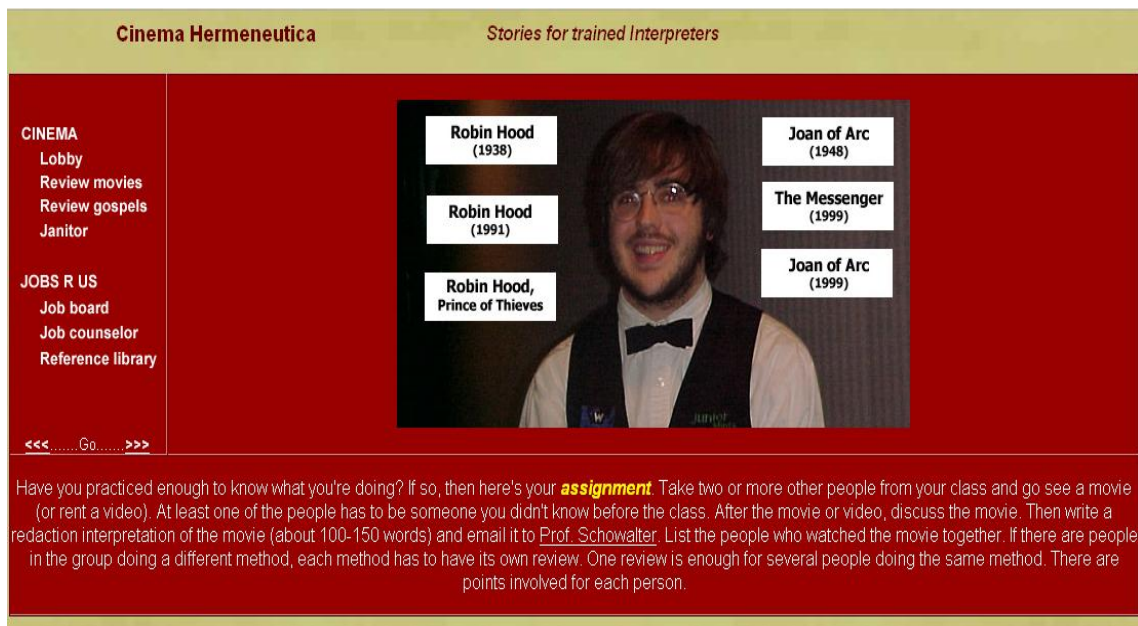
Activity metaphor: a temporary job; the job counselor introduces the potential applicants to each of the four magazines: a) Tales Told – narrative criticism; b) Wo/men – feminist interpretation; c) One More Time – the redaction criticism; and d) Just the Facts – historical criticism.



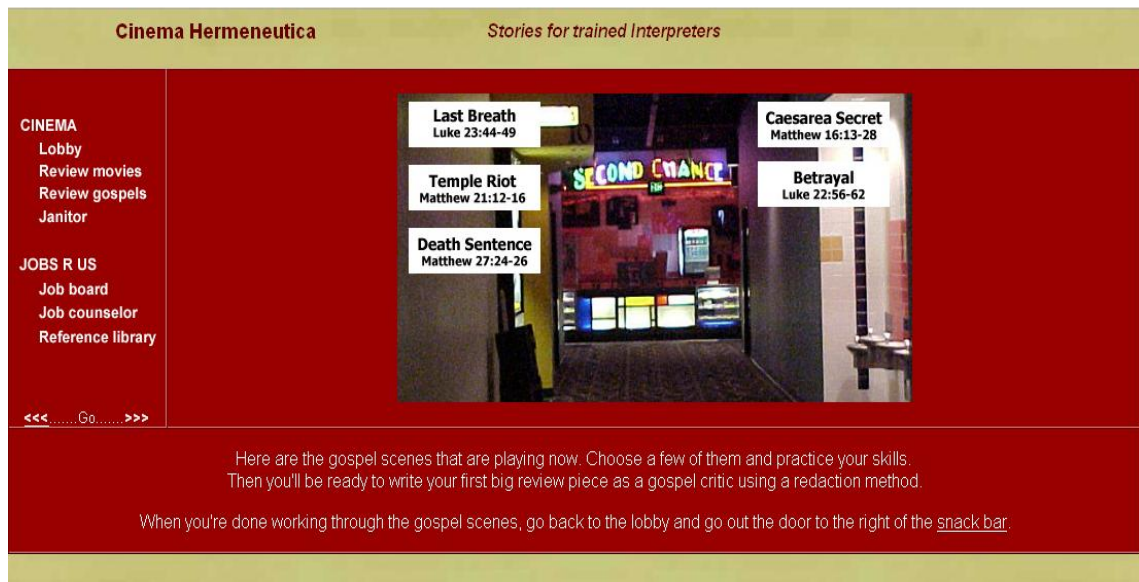
Instructional tasks: once the preferred job selected and the basic training completed each interpreter has to engage first in reviewing movies and the gospels from the perspective of chosen magazine.



To exemplify, the following screenshots presents the major steps for the redaction criticism section. The entry page: the *movie review* for redaction criticism.



The entry page: the *gospel review* for redaction criticism.



The interface for the practice page: the gospel review for redaction criticism; instant feedback is provided for each of the questions that guide the interpretation method.

The screenshot shows a green web interface for a practice exercise titled 'Incident at Caesarea Philippi' with the reference 'Matthew 16:13-28 (Mark 8:27-9:1)'. Below the title is a link 'click for the text'. There are five numbered questions, each with a text input field and an 'OK' button. The first question is '1. What source or sources did the redactor use for this text?' with the answer 'historical source'. The second question is '2. What did the redactor add? delete?' with the answer 'nothing'. The third question is '3. What did the redactor reuse in way that is changed?'. The fourth question is '4. How do these differences affect the overall impact of the gospel text?'. The fifth question is '5. What does the new version tell us about the redactor's social situation?'. On the right side, there is a white box with the text 'Your response is: historical source' and 'Suggested answer: The redactor used Mark and M (special Matthean material)'. At the bottom, there is a link 'Choose another gospel text to review'.

APPENDIX C

Scoring Rubric for Pretest, Posttest, and Delayed-Posttest Short Essays

Pretest essay– Scoring Rubric

Score	Description of the performance
6	Right point: Don't trust in material goods; or don't use God's gifts for ones own pleasure.
5	Right point mixed with other material; or seems like right point but mostly retells text so nuance is hard to detect.
4	Close to main point but a little off track; focus not quite right.
3	Wrong point but connected to the text in some way
2	Student interpretation not supported by text.
1	Student's interpretation unclear: Response is not consistent with itself or not coherent

Posttest essay– Scoring Rubric

Score	Description of the performance
6	Right point: Jesus' mission is to those considered sinners, not to those who think they are righteous; (either: sinners instead of righteous, or sinners because they need more help)
5	Right point mixed with other material
4	Close to main point but a little off track; focus not quite right.
3	Wrong point but connected to the text in some way
2	Student interpretation not supported by text.
1	Student's interpretation unclear: Response is not consistent with itself or not coherent

Delayed Posttest essay– Scoring Rubric

Score	Description of the performance
6	Right point: Help people who can't repay you and God will repay you at resurrection
5	Right point mixed with other material; or seems like right point but mostly retells text so nuance is hard to detect (has repayment aspect but imports other ideas). If you help poor, it shows good character and this will be rewarded in resurrection. Help the poor with selfless kindness and you store up treasures in heaven. Help poor because goal of life is heaven and you'll be repaid there. Help poor and reward comes in heaven; also Jesus came for everyone.
4	Close to main point but a little off track; focus not quite right (emphasis on no repayment). Help needy even though it won't be noticed by others. If you serve those who need it, its real servanthood and God will bless. Help poor, don't be selfish, and don't have wrong motives. Help the poor because is right, not because you think you should.
3	Wrong point but connected to the text in some way (no reference to resurrection/ afterlife; or several answers). Don't do charity to be repaid or praised.
2	Student interpretation not supported by text.
1	Student's interpretation unclear: response is not consistent with itself or not coherent.

Quality of the argumentation – Scoring Rubric

Score	Description of the performance
5	All ideas in the paper flow logically; the argument is identifiable, reasonable, and sound.
4	Argument of paper is clear, usually flows logically and makes sense.
3	Logic may often fail, or argument often unclear.
2	Ideas do not flow, argument not clear.
1	Ideas totally fragmented, no argument, mainly a collection of raw ideas copied from the text with no logic of linkage among them.

APPENDIX D

Epistemic Beliefs Inventory: content, factor loadings, and paired comparison

Table D1

Epistemic Beliefs Inventory Items (Schraw, Bendixen, & Dunkle, 2002, p. 275)

A. Please indicate how much you agree with the following statements by using the provided scale	Strongly Disagree		Strongly Agree	
1. Most things worth knowing are easy to understand.	1	2	3	5
2. What is true is a matter of opinion.	1	2	3	5
3. Students who learn things quickly are the most successful.	1	2	3	5
4. People should always obey the law.	1	2	3	5
5. People's intellectual potential is fixed at birth.	1	2	3	5
6. Absolute moral truth does not exist. ^a	1	2	3	5
7. Parents should teach their children all there is to know about life.	1	2	3	5
8. Really smart students don't have to work as hard to do well in school.	1	2	3	5
9. If a person tries too hard to understand a problem, they will most likely end up being confused.	1	2	3	5
10. Too many theories just complicate things.	1	2	3	5
11. The best ideas are often the most simple.	1	2	3	5
12. Instructors should focus on facts instead of theories.	1	2	3	5
13. Some people are born with special gifts and talents.	1	2	3	5
14. How well you do in school depends on how smart you are.	1	2	3	5
15. If you don't learn something quickly, you won't ever learn it.	1	2	3	5
16. Some people just have a knack for learning and others don't.	1	2	3	5
17. Things are simpler than most professors would have you believe.	1	2	3	5
18. If two people are arguing about something, at least one of them must be wrong.	1	2	3	5
19. Children should be allowed to question their parents' authority. ^a	1	2	3	5
20. If you haven't understood a chapter the first time through, going back over it won't help.	1	2	3	5
21. Science is easy to understand because it contains so many facts.	1	2	3	5
22. The more you know about a topic, the more there is to know.	1	2	3	5
23. What is true today will be true tomorrow.	1	2	3	5
24. Smart people are born that way.	1	2	3	5
25. When someone in authority tells me what to do, I usually do it.	1	2	3	5

Note: ^a Reversed keyed;

Table D1 - continuing

Epistemic Beliefs Inventory Items (Schraw et al., 2002, p. 275)

A. Please indicate how much you agree with the following statements by using the provided scale		Strongly Disagree			Strongly Agree	
26.	People shouldn't question authority.	1	2	3	4	5
27.	Working on a problem with no quick solution is a waste of time.	1	2	3	4	5
28.	Sometimes there are no right answers to life's big problems.	1	2	3	4	5
29.	The moral rules I live by apply to everyone. ^b	1	2	3	4	5

Note: ^b Item not in the original list but is part of Factor 2 in Schraw's final scale (2002, p. 267);

Table D2

EBI Factors¹, item-to-factor loadings, eigenvalues, and values of coefficient alpha

<i>Factor 1: Omniscient Authority (Eigenvalue = 1.76; alpha=.73)</i>	People should not question authority (.77)
	Children should be allowed to question their parents (.62) ²
	People should always obey the law (.51) ³
<i>Factor 2: Innate Ability (Eigenvalue = 1.68; alpha=.69)</i>	Smart people are born that way (.79)
	People's intellectual potential is fixed at birth (.68) ³
	Really smart students don't have to work as hard to do well (.56)
<i>Factor 3: Quick Learning (Eigenvalue = 1.57; alpha=.73)</i>	Working on a problem with no quick solution is a waste of time (.89)
	If you haven't understood a chapter the first time, going back won't help (.57)
	If you don't learn something quickly, you won't ever learn it (.46)
<i>Factor 4: Certain Knowledge (Eigenvalue = 1.24; alpha=.64)</i>	Absolute moral truth does not exist (.65) ^{2,3}
	The moral rules I live by apply to everyone (.58)
	What is true today will be true tomorrow (.49)
<i>Factor 5: Simple Knowledge (Eigenvalue = 1.18; alpha=.63)</i>	The best ideas are often the most simple (.62) ³
	Instructors should focus on facts instead of theories (.61)
	Things are simpler than most professors would have you believe (.54) ³

Notes: ¹ Cutoff for item-load of .45 (20% of variance); ² Reversed scale; ³ Not in Schraw et al. (2002) scale;

Table D3

Paired comparison of the new and original EBI scales for the four factors with different loadings

Factor	New EBI scale		Schraw et al. scale (2002)		Pearson correlation	t (101)
	Item *	Alpha/ mean, SD	Item *	Alpha, mean, SD		
Omniscient Authority	26	alpha = .73	26	alpha = .71	.91**	-1.29
	19	M = 9.15	19	M = 9.28		
	4	SD = 2.50	25	SD = 2.37		
Innate Ability	24	alpha = .69	24	alpha = .61	.88**	-1.46
	5	M = 7.58	14	M = 7.75		
	8	SD = 2.51	8	SD = 2.35		
Certain Knowledge	6	alpha = .64	7	alpha = .50	.88**	10.14**
	29	M = 9.66	29	M = 8.30		
	23	SD = 2.81	23	SD = 2.47		
Simple Knowledge	11	alpha = .63	10	alpha = .59	.69**	3.33**
	12	M = 8.88	12	M = 8.31		
	17	SD = 2.16	1	SD = 2.19		

Note: * The number for each item marked according to Table A4.1 above;

** Significant at the .01 level (2 tailed);

Schraw, G., Bendixen, L. D., & Dunkle, M. E. (2002). Development and validation of the Epistemic Belief Inventory (EBI). In B. K. Hofer & P. R. Pintrich (Eds.), *Personal Epistemology: The Psychology of Beliefs About Knowledge and Knowing* (pp. 261-275). Mahwah, NJ: Lawrence Erlbaum Associated, Publishers.

APPENDIX E

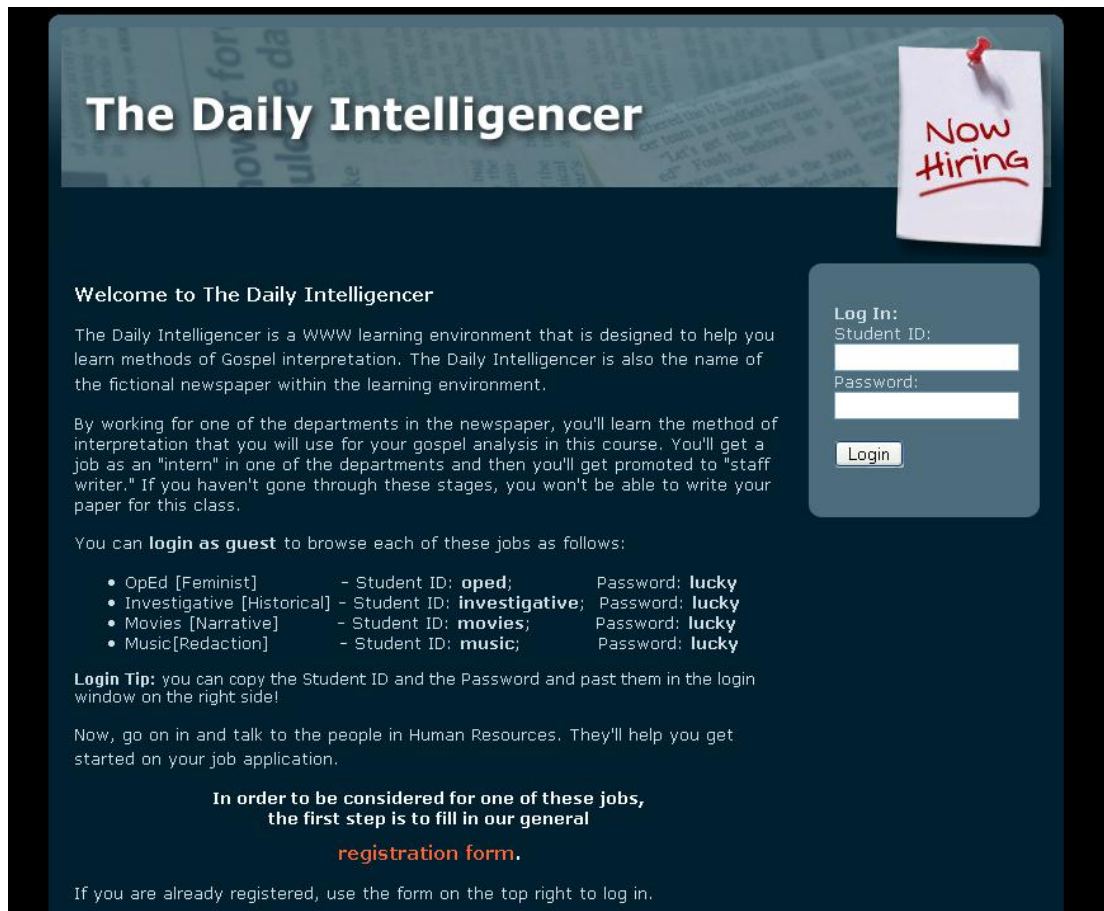
Students' majors and their grouping

Code	Major
1 - Humanities	English Foreign Language Religious studies Political sciences History Communications Philosophy Music theory Interdisciplinary studies Arts in Religious studies and Political science Art, Art-graphic design, Art history Ceramics and secondary art Technical theatre
2 - Social Studies	Psychology Sociology Journalism/ Pre-journalism Photo-journalism Social work Elementary education Education Secondary education Agricultural education Family studies
3 - Hard Sciences	Business, Economics Accounting, Finance International business Biological sciences Animal science/ Plant science Chemistry/ Math/ Physics Food science Diagnostic medical ultrasound Nursing Radiography/ radiology Pre-physical therapy Nutrition and fitness Mechanical/ Civil engineering Electrical/ Chemical/ Biological engineering Computer science/ engineering
4 - Undecided/ undeclared	

APPENDIX F

The Daily Intelligencer

Main metaphor a virtual newspaper that has openings for four jobs: a) OpEd – feminist interpretation; b) Investigative – historical criticism; c) Movie section – narrative criticism; and d) Music section – redaction criticism.

The image is a screenshot of a web application titled "The Daily Intelligencer". The background is dark blue with a faint newspaper pattern. At the top, the title "The Daily Intelligencer" is in large white letters. To the right, there is a white sticky note with a red pushpin and the text "Now Hiring" in red. Below the title, there is a "Welcome to The Daily Intelligencer" section. It contains a paragraph about the learning environment and a list of four jobs: OpEd [Feminist], Investigative [Historical], Movies [Narrative], and Music [Redaction]. Each job has a corresponding Student ID and Password. A "Login Tip" is provided, and a "Login" button is visible. At the bottom, there is a registration form link and a note about existing users.

The Daily Intelligencer

Welcome to The Daily Intelligencer

The Daily Intelligencer is a WWW learning environment that is designed to help you learn methods of Gospel interpretation. The Daily Intelligencer is also the name of the fictional newspaper within the learning environment.

By working for one of the departments in the newspaper, you'll learn the method of interpretation that you will use for your gospel analysis in this course. You'll get a job as an "intern" in one of the departments and then you'll get promoted to "staff writer." If you haven't gone through these stages, you won't be able to write your paper for this class.

You can **login as guest** to browse each of these jobs as follows:

- OpEd [Feminist] - Student ID: **oped**; Password: **lucky**
- Investigative [Historical] - Student ID: **investigative**; Password: **lucky**
- Movies [Narrative] - Student ID: **movies**; Password: **lucky**
- Music [Redaction] - Student ID: **music**; Password: **lucky**

Login Tip: you can copy the Student ID and the Password and past them in the login window on the right side!

Now, go on in and talk to the people in Human Resources. They'll help you get started on your job application.

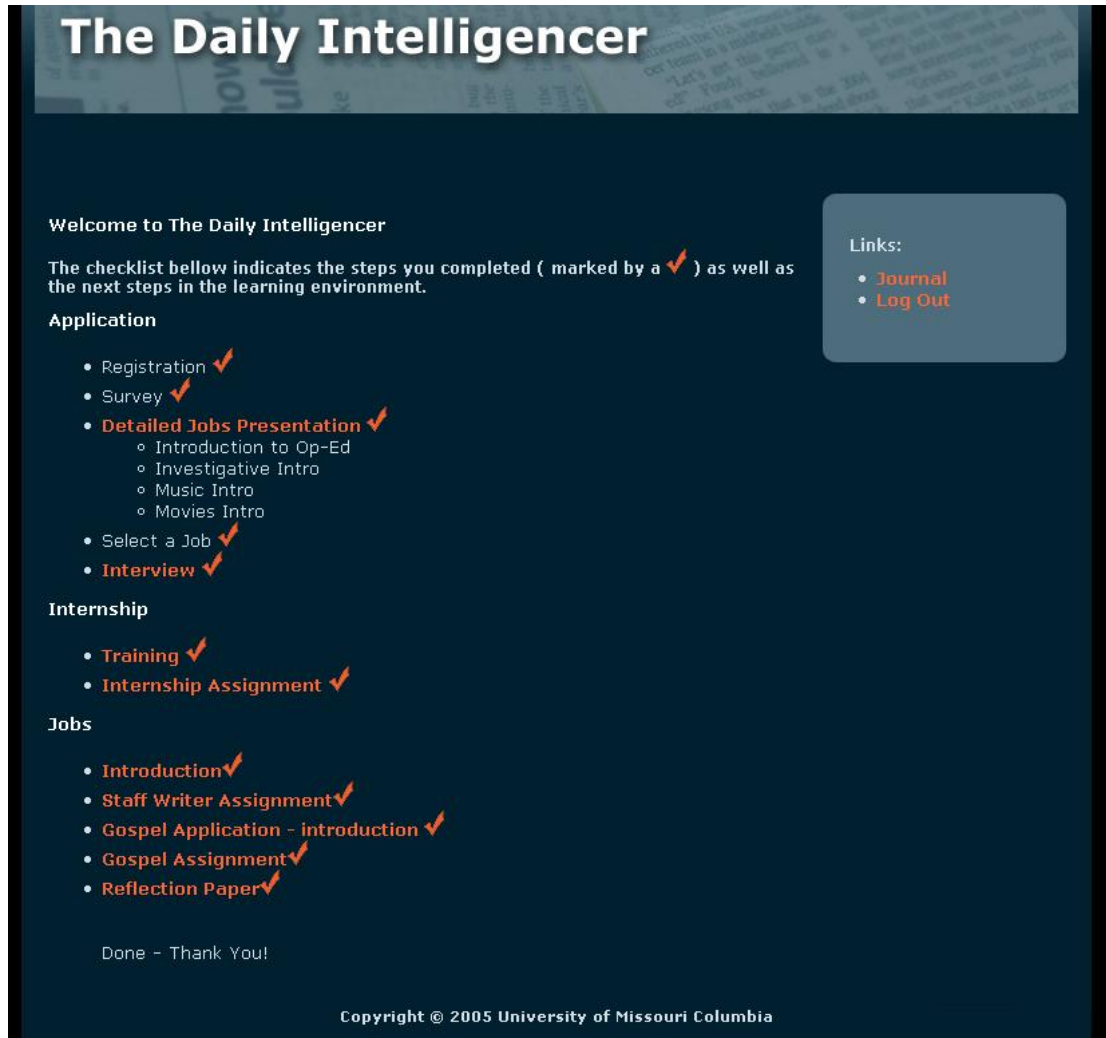
In order to be considered for one of these jobs, the first step is to fill in our general registration form.

If you are already registered, use the form on the top right to log in.

Log In:
Student ID:
Password:

This version of the environment offers a virtual space for each student which needs to register and set up a password to access the online environment which will provide also feedback on both the current task and the completed tasks. The front page also offers guest logins and passwords that allow guests and students to navigate through the tasks of any of the four jobs.

Structure of the activities has three main categories: a) job application; b) internship activities; and c) Staff activities.



The application process generates three major outcomes. First, the registration and the application survey allow the researcher to collect demographic and epistemic beliefs data. Second, the detailed job presentation exposes students to all four methods to help them decide which one to apply for. Third, the job interview that follows the selection of the job allows the researcher to collect the entry-level skills data.


Very important yet, these three steps increase the authenticity of the task as they are common steps in any hiring process.

The internship introduces students to the basics of the method through a non-gospel activity specific for each job. Following the internship stage, the staff assignment introduces higher levels of complexity. The senior staff assignment introduces the gospel texts and offers several opportunities for a guided analysis of these texts. The senior staff assignment has as culminating task a major gospel interpretation essay. The following screenshots present sequence of these activities for OpEd that is feminist interpretation.

The *intern training* has several steps that introduce the method-specific analysis through a worked example based on a series of questions developed by the expert.

The Daily Intelligencer

1.0



Senior Editor

Are you the new intern? Welcome to the Op-Ed department! I'm the senior editor. We're swamped right now so we want to put you to work right away. But first of all, we have to give you some training. You'll start out as an intern and work your way up to staff writer.

Next

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Navigate:

1. Intern Training
 - Intro
 - 1.1
 - 1.2
 - 1.3
 - 1.4
 - 1.5
 - 1.6
 - 1.7
 - 1.8
 - 1.9

Links:

- Checklist
- Log Out

Staff assignment: the first independent assignment that allows students to build on the skills and knowledge from both the intern training and from the introduction to the staff role.

Staff Writer Assignment



Links:

- [Checklist](#)
- [Log Out](#)

Okay, now you're ready for your first assignment: a letter to an editor on an issue that affects women's lives in an unjust way.

- Chose a different news story than the one you used in your analysis as an intern. It has to be one that's been in the news during the past 7 days (the last 3 is better)
- Think about the story in terms of fundamental feminist issues, and use a hermeneutics of suspicion.
- Write a letter to the editor (100 - 150 words).
- Copy paste the letter in the form below and submit it for a grade.
- Submit the letter to at least two regularly published newspapers
- Post the letter on the WebCT Op-Ed board.

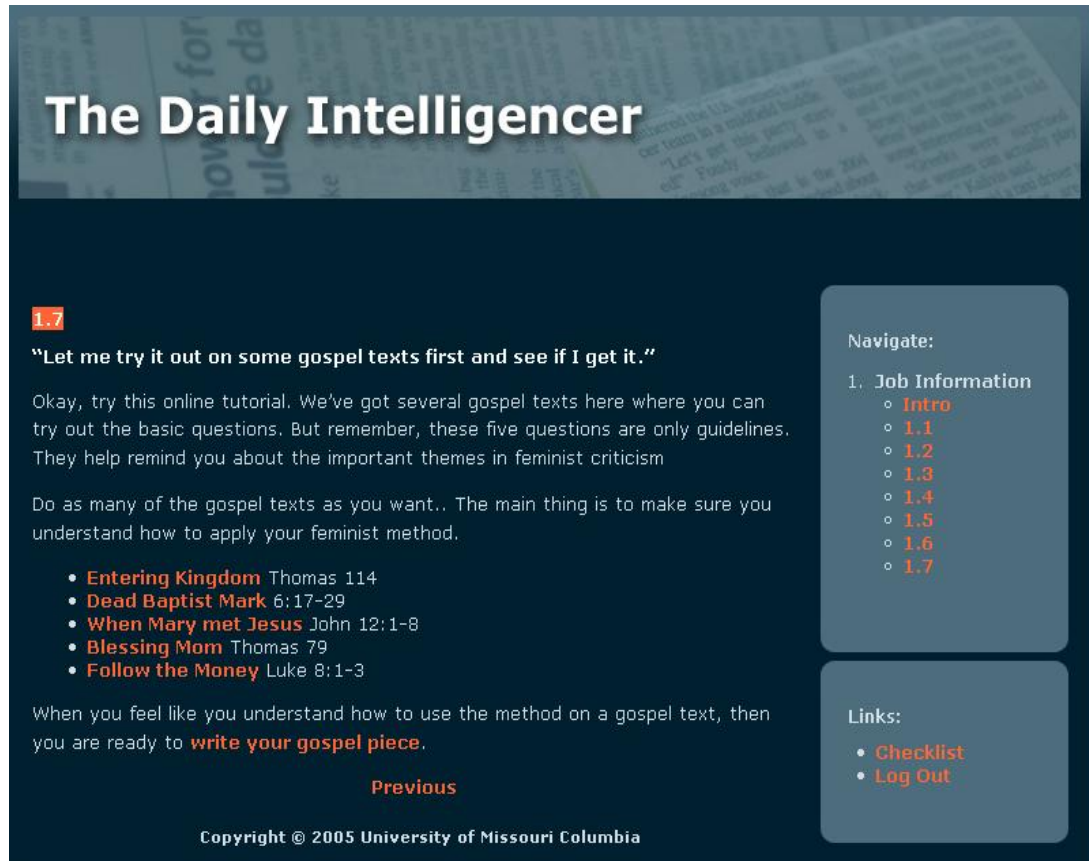
If your letter gets accepted for publication, **let the senior editor (your instructor) know about it!**

Read suggestions for letters to the editor.

Instructions: Type out the answers to the questions above in the text editor of your choice (where you have access to spell check) and then copy paste your asnwers into the form below. You will not be able to edit this text once you hit submit. Do not click submit more than once.

sample text

Gospel practice: the opportunity to practice the method-specific skills on gospel texts.



The screenshot shows a website titled "The Daily Intelligencer" with a background image of newspaper text. The main content area is dark blue. On the right, there are two light blue boxes for navigation and links. The main text is white, with some links in orange.

The Daily Intelligencer

1.7

"Let me try it out on some gospel texts first and see if I get it."

Okay, try this online tutorial. We've got several gospel texts here where you can try out the basic questions. But remember, these five questions are only guidelines. They help remind you about the important themes in feminist criticism

Do as many of the gospel texts as you want.. The main thing is to make sure you understand how to apply your feminist method.

- **Entering Kingdom** Thomas 114
- **Dead Baptist Mark** 6:17-29
- **When Mary met Jesus** John 12:1-8
- **Blessing Mom** Thomas 79
- **Follow the Money** Luke 8:1-3

When you feel like you understand how to use the method on a gospel text, then you are ready to **write your gospel piece**.

[Previous](#)

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Navigate:

1. Job Information
 - **Intro**
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 - **1.6**
 - **1.7**


Links:

- **Checklist**
- **Log Out**

Gospel assignment: the culminating activity for the online activity that also offers the opportunity for feedback prior to the midterm exam that concludes the gospel section for The Introduction to the New Testament course.

The Daily Intelligencer

Internship Assignment



Associate Editor in charge of Internships

Links:

- [Checklist](#)
- [Log Out](#)

Okay. Now it's your turn to get all steamed up. In order to finish your training as an intern in the Op-Ed department, you need to do this kind of feminist analysis of a story in the news. Here's what you do:

- Pick an issue that's been in a newspaper sometime during the last 7 days.
- Open a word-processing document and write 100-150 words about it.
- Make sure you deal with the fundamental feminist issues.
- **Submit your analysis in THREE places:**
 - 1) "Turn in your work" link in WebCT for your grade;
 - 2) Copy and paste it in the window below to advance in your career;
 - 3) post in the OpEd bulletin board in WebCT for others to see.

Instructions: Type out the answers to the questions above in the text editor of your choice (where you have access to spell check) and then copy paste your answers into the form below. You will not be able to edit this text once you hit submit. Do not click submit more than once.

sample textflighjd[0r9g

APPENDIX G

Entry-Level and The Daily Intelligencer Essays

Entry-Level Essays

The task, the text(s) and associated scoring rubrics used in assessing students' entry-level skills

Single source methods: Narrative Criticism and Feminist Interpretation	
Task	What do you think is the main point of the story? Keep your answer in the 100-150 word range
Text	<p><i>Mark 5:21-43</i></p> <p>When Jesus had crossed again in the boat to the other side, a great crowd gathered around him; and he was by the sea. Then one of the leaders of the synagogue named Jairus came and, when he saw him, fell at his feet and begged him repeatedly, "My little daughter is at the point of death. Come and lay your hands on her, so that she may be made well, and live." So he went with him.</p> <p>And a large crowd followed him and pressed in on him. Now there was a woman who had been suffering from hemorrhages for twelve years. She had endured much under many physicians, and had spent all that she had; and she was no better, but rather grew worse. She had heard about Jesus, and came up behind him in the crowd and touched his cloak, for she said, "If I but touch his clothes, I will be made well." Immediately her hemorrhage stopped; and she felt in her body that she was healed of her disease. Immediately aware that power had gone forth from him, Jesus turned about in the crowd and said, "Who touched my clothes?" And his disciples said to him, "You see the crowd pressing in on you; how can you say, 'Who touched me?'" He looked all around to see who had done it. But the woman, knowing what had happened to her, came in fear and trembling, fell down before him, and told him the whole truth. He said to her, "Daughter, your faith has made you well; go in peace, and be healed of your disease."</p> <p>While he was still speaking, some people came from the leader's house to say, "Your daughter is dead. Why trouble the teacher any further?" But overhearing what they said, Jesus said to the leader of the synagogue, "Do not fear, only believe." He allowed no one to follow him except Peter, James, and John, the brother of James. When they came to the house of the leader of the synagogue, he saw a commotion, people weeping and wailing loudly. When he had entered, he said to them, "Why do you make a commotion and weep? The child is not dead but sleeping." And they laughed at him. Then he put them all outside, and took the child's father and mother and those who were with him, and went in where the child was. He took her by the hand and said to her, "Talitha cum," which means, "Little girl, get up!" And immediately the girl got up and began to walk about (she was twelve years of age). At this they were overcome with amazement. He strictly ordered them that no one should know this, and told them to give her something to eat.</p>
Content Scoring Rubric	<p>[6] Right main point</p> <p>[5] Right main point mixed with other material</p> <p>[4] Close to main point, but a little off track, focus not right.</p> <p>[3] Wrong point, but connected to text in some way</p> <p>[2] Student interpretation not supported by text</p> <p>[1] Student's interpretation unclear: inconsistent or incoherent.</p>

Two sources method: Historical Criticism	
Task	How would you explain the differences between these two versions of the same story? Keep your answer in the 100-150 word range.
Texts	<p><i>Text 1: Mark 5:21-43</i> (see Redaction Criticism above)</p> <p><i>Text 2: Luke 8:40-56</i></p> <p>Now when Jesus returned, the crowd welcomed him, for they were all waiting for him. Just then there came a man named Jairus, a leader of the synagogue. He fell at Jesus' feet and begged him to come to his house, for he had an only daughter, about twelve years old, who was dying.</p> <p>As he went, the crowds pressed in on him. Now there was a woman who had been suffering from hemorrhages for twelve years; and though she had spent all she had on physicians, no one could cure her. She came up behind him and touched the fringe of his clothes, and immediately her hemorrhage stopped. Then Jesus asked, "Who touched me?" When all denied it, Peter said, "Master, the crowds surround you and press in on you." But Jesus said, "Someone touched me; for I noticed that power had gone out from me." When the woman saw that she could not remain hidden, she came trembling; and falling down before him, she declared in the presence of all the people why she had touched him, and how she had been immediately healed. He said to her, "Daughter, your faith has made you well; go in peace."</p> <p>While he was still speaking, someone came from the leader's house to say, "Your daughter is dead; do not trouble the teacher any longer." When Jesus heard this, he replied, "Do not fear. Only believe, and she will be saved." When he came to the house, he did not allow anyone to enter with him, except Peter, John, and James, and the child's father and mother. They were all weeping and wailing for her; but he said, "Do not weep; for she is not dead but sleeping." And they laughed at him, knowing that she was dead. But he took her by the hand and called out, "Child, get up!" Her spirit returned, and she got up at once. Then he directed them to give her something to eat. Her parents were astounded; but he ordered them to tell no one what had happened.</p>
Content Scoring Rubric	<p>[6] Student makes hypothesis/hypotheses about the editor's work based on differences in the two versions.</p> <p>[5] Student identifies differences and organizes them in some way.</p> <p>[4] Student lists differences.</p> <p>[3] Description too general, can't tell if student is analyzing text because there are no specifics, no differences mentioned.</p> <p>[2] Inaccurate description, or going off on tangential topics.</p> <p>[1] Incoherent, contradictory, or completely irrelevant response.</p>

Two sources method: Redaction Criticism	
Task	How would you explain the differences between these two versions of the same story? Keep your answer in the 100-150 word range.
Texts	<p><i>Text 1: Mark 5:21-43</i> (see Redaction Criticism above)</p> <p><i>Text 2: Matt 9:18-26</i></p> <p>While he was saying these things to them, suddenly a leader of the synagogue came in and knelt before him, saying, "My daughter has just died; but come and lay your hand on her, and she will live." And Jesus got up and followed him, with his disciples. Then suddenly a woman who had been suffering from hemorrhages for twelve years came up behind him and touched the fringe of his cloak, for she said to herself, "If I only touch his cloak, I will be made well." Jesus turned, and seeing her he said, "Take heart, daughter; your faith has made you well." And instantly the woman was made well. When Jesus came to the leader's house and saw the flute players and the crowd making a commotion, he said, "Go away; for the girl is not dead but sleeping." And they laughed at him. But when the crowd had been put outside, he went in and took her by the hand, and the girl got up. And the report of this spread throughout that district.</p>
Content Scoring Rubric	<p>[6] Student makes hypothesis/hypotheses about the editor's work based on differences in the two versions.</p> <p>[5] Student identifies differences and organizes them in some way.</p> <p>[4] Student lists differences.</p> <p>[3] Description too general, can't tell if student is analyzing text because there are no specifics, no differences mentioned.</p> <p>[2] Inaccurate description, or going off on tangential topics.</p> <p>[1] Incoherent, contradictory, or completely irrelevant response.</p>

The Daily Intelligencer Essays: Intern Task, Staff Task, Gospel Task

Criticism Method	Task
Intern Task	
Feminist	<p>Now it's your turn to get all steamed up. In order to finish your training as an intern in the Op-Ed department, you need to do this kind of feminist analysis of a story in the news. Here's what you do:</p> <ul style="list-style-type: none"> - Pick an issue that's been in a newspaper sometime during the last 7 days. - Open a word-processing document and write 100-150 words about it. - Make sure you deal with the fundamental feminist issues.
Historical	<p>Now it's your turn to do some writing. In order to finish your training as an intern in the Investigative Reporting department, you need to explain what the developer's lawyer really said, and how certain your conclusion is. Here's what you do:</p> <ul style="list-style-type: none"> - Look over the paragraph about when the store will open in both articles. - Open a word-processing document and write 100-150 words about it. - Make sure you deal with your level of certainty.
Narrative	<p>Now it's your turn. In order to finish your training as an intern in the movie department, you need to identify the characters in a movie. Here's what you do:</p> <ul style="list-style-type: none"> - Pick a well-known movie that you've seen where the main character might not be clear at first glance. - Open a word-processing document and write 100-150 words about the movie. - <i>You should identify</i> the main character, prominent opponents, and important allies. Make sure you defend your choices by giving reasons for your conclusions.
Redaction	<p>Now it's your turn to choose. In order to finish your training as an intern in the music department, you need to do this kind of redaction analysis of a song that has been re-recorded. Here's what you do:</p> <ul style="list-style-type: none"> - Pick a song that has been recorded more than once. Sometimes it's easier to do a song where there's a great deal of time between the two versions, but that isn't always true. - Open a word-processing document and write 100-150 words about it. - Make sure you deal with the additions, deletions, and transformations.
Staff Task	
Feminist	<p>Now you're ready for your first assignment: a letter to an editor on an issue that affects women's lives in an unjust way.</p> <ul style="list-style-type: none"> - Chose a different news story than the one you used in your analysis as an intern. It has to be one that's been in the news during the past 7 days (the last 3 is better) - Think about the story in terms of fundamental feminist issues, and use a hermeneutics of suspicion. - Write a letter to the editor (100 - 150 words).

Criticism Method	Staff Task
Historical	<p>If the Wal-Mart story seems too tame, let's try it with a more controversial topic, one where getting the facts right might mean life and death for someone. Here are links from the Jerusalem Post and from Al Jazeera about Israeli tank fire that killed several Palestinians in northern Gaza. The tank fire came after Palestinian rocket attacks on Israel. It's a very messy, tragic story. But that's what we deal with here in IR (Al Jazeera article; Jerusalem Post article). This is your first assignment as staff writer is this: figure out whether the people killed by the tank fire were militant members of Hamas attacking Israel, or Palestinian children working on the family farm. You should:</p> <ul style="list-style-type: none"> - Write out your conclusion and reasons for it (100-150 words). - Use our four criteria if they apply. - Indicate your level of certainty.
Narrative	<p>Okay, now you're ready for your first assignment: a short review of a movie.</p> <ul style="list-style-type: none"> - Go see a movie or watch a video with some people from your New Testament class. Don't just try to remember something you've already seen. Watch the movie with questions about plot and characters in mind. - Try to include someone you don't know in the group. This is a great chance to meet new people. They don't have to work for the entertainment section. - After you watch the flick, discuss the characters and plot. - Write a review of the movie (100-150 words).
Redaction	<p>Okay, now you're ready for your first assignment: a critique of a re-recorded song.</p> <ul style="list-style-type: none"> - You can use the song you posted to the playlist, or you can do a different one. It doesn't matter. Don't do one that's already on the playlist, though, unless you have a good reason. - In your analysis, write about the subjects we've discussed: changes, transformations, social setting, overall impact on listeners. - Write a critique that's 100-150 words in length.
Gospel Task	
All Methods	<p>Your analysis should focus on the story found in [Mark 5:21-43 for Feminist interpretation and Narrative Criticism; Mark 5:21-43 and Luke 8:40-56 for Historical and Redaction Criticism – see Entry-Level Essays above].</p> <p>The senior editor for the religion section sets the guidelines for your article:</p> <ul style="list-style-type: none"> - Write a first draft a week ahead of time. Write more than the assigned word limit (750-850 words). Let the draft sit for a couple days. - Ask a friend or a colleague from your section to read it and give you feedback. - Rewrite your first draft using the feedback from your peer reviewer. Condense the best material in your draft down to the word limit. Does the paper have a clear thesis at the beginning? A clear conclusion at the end that matches the thesis? Logical steps that lead from the thesis to the conclusion? - Repeat steps 1-3 as often as you can before the due date.

Rubric to score writing to argue or persuade
adapted from Glasswell, Parr, & Aikman, (2001)

**All Methods
&
All Tasks**

A. Context and position: define a position based on the biblical criticism method used

4. Position is evident, clearly stated, consistent and method-centered;
3. Position stated, somewhat consistent, and method-centered;
2. Position existent but unclear and poorly centered on the method used;
1. No clear position

B. Coherence and flow: how well the language and writing style support the stated position

4. The language and the writing style generally support writer's position, are consistent and method-driven throughout the essay;
3. The language and the writing style provide some support to writer's position, are consistent and method-driven for most of the essay;
2. The language and the writing style provide poor support to writer's position, are often inconsistent with only few method-driven elements;
1. The language and the writing style do not support writer's position, are inconsistent, and there is no evidence of method use.

C. Content inclusion: provides a structured and logical presentation of the information

4. All or most of the argument elements (i.e. thesis, main points, evidence, or restatement) are comprehensive and relevant to the method;
 3. More than half of the argument elements (i.e. thesis, main points, evidence, or restatement) are well developed and relevant to the method;
 2. About half of the argument elements (i.e. thesis, main points, evidence, or restatement) are developed and relevant to the method;
 1. Only few or none of the argument elements (i.e. thesis, main points, evidence, or restatement) are present and relevant to the method;
-

The Daily Intelligencer Reflection Essay

Task	The following two essays reflect your growth from the initial interview to your gospel assignment. Write a short essay (150-200 words) about how your level of understanding has changed, how it has remained the same, and why.
Texts	<p>The entry-level essay and the gospel essay presented to the students were based on the same gospel passage (see the entry-level skills rubric above)</p> <p>A. Statement of similarities and differences (compare and contrast)</p> <p style="padding-left: 40px;">1 – clear and overt statement .5 – some or implied statement 0 – none</p> <p>B. Statement of change</p> <p style="padding-left: 40px;">1 – present and clear .5 – present but unclear 0 – none</p> <p>C. Evidence of method impact</p> <p style="padding-left: 40px;">1 – method clearly mentioned (name, components, etc.) .5 – some or implicit indications of the method use 0 – none</p> <p>D. Acknowledge the impact of the learning process (e.g. tools, lectures, readings)</p> <p style="padding-left: 40px;">1 – explicit .5 – implicit 0 – none</p> <p>E. Transfer to other domains or to personal growth</p> <p style="padding-left: 40px;">1 – clearly stated .5 – implied but not stated 0 – none</p>
Content rubric	

Glasswell, K., Parr, J., & Aikman, M. (2001). *Development of the asTTle writing assessment scoring rubrics: Report and recommendations. (Technical Report 6)*. Auckland, NZ: University of Auckland, Project asTTle. Available online at:
<http://www.tki.org.nz/r/asTTle/pdf/technical-reports/techreport06.pdf>.

APPENDIX H

Interview protocols, Informed Consent Forms, and materials used during the interviews

New Testament – Student Exit Interview

Spring 2005

Intro protocol

Thank you for participating in this interview. First, I will like to remind you that your participation is completely voluntarily and that there are no anticipated risks or discomforts. You have the right to withdraw at any time with no repercussions. Second, your responses are completely confidential as stated in the informed consent statement. As you can see, I assigned an interview code to all outputs of this interview.

Now, I will like to make clear that this is not a test, and there is no “right”, “wrong” or “expected” answer to my question. I am interested in your understanding of the gospel part of your course and the role of the computer environment you used. I will start with more generic questions and gradually I will turn toward more specific questions related to the computer environment

Warm up questions

Q1. Tell me a little bit about your academic background, and what motivated you to enroll in the New Testament course this spring semester?

Probing questions (P):

- Does it relate to your academic interest?

Or

- o As I understand it, motivation relates only to academic interests.

- Does it relate to some of your personal interests?

Or

- o As I understand it, motivation relates only to your personal interests.

- Does it relate to both your academic and personal interests?

Or

- o As I understand it, motivation relates to both your academic and personal interests.

Q2. How would you define religion studies?

P: In your opinion, is there an academic definition of religious studies and a non-academic one? How do you see this relationship?

Q3. Overall, does this part (Gospel part) of the course meet your expectations so far? Can you explain why it does or why it does not?

P: In terms of teaching, what was different (if anything) in this class compared to other classes you participated in so far?

Q4. How did your understanding of Religion changed (if it changed at all) after this part of the course? Can you explain?

Conceptual understanding questions

Q5. Students will be randomly assign one of the two following questions that are equivalent:

Q5_1 (C-map environment - <http://www.coe.missouri.edu/~danc04/cmap/>). On screen you can see 36 concepts related to a higher or lower degree to the topic of your class – gospel analysis. These concepts are randomly displayed on the screen. You can move them anywhere in the blue space of the screen. Now please group them based on their similarity; the more similar they are the closer they should be, and the more dissimilar they are the farther they should be. As you move them, **please think aloud...show your thinking, your question marks (if any), your frustrations.**

P (if long silence periods occur):

Why did you choose that concept as part of this group? Can you tell what are you doing or thinking? Do you have any doubts about this choice? Why?

P: (After the map was finished) Now that you finished it, can you describe what this map is telling you? How would you read this map?

Q5_2 (Use Inspiration map; give the student 5 to 7 minutes as introduction to the mechanics of Inspiration software).

On the page that you have here are 36 concepts related to a higher or lower degree to the topic of your class – gospel analysis. They are randomly placed in three columns. One word in each column is crossed-over and it appears on the computer screen as an example of a concept map. Please place all the remaining words on the map and link them as they fit together. As you will use a word, please cross-it-over.

As you move them **please think aloud...show your thinking, your question marks (if any), your frustrations.**

P (if long silence periods occur):

Why did you choose these concepts as part of this group? Can you tell what are you doing or thinking? Do you have any doubts about this choice? Why?

P: (After the map was finished) Now that you finished it, can you describe what this map is telling you? How would you read this map?

Q6. Please take 2 minutes and read these two gospel stories (Mark and Matt); if the student was not exposed to Inspiration in the previous question, give the student a short (5 – 7 minutes) introduction to the mechanics of Inspiration software.

Q6.1 Now that you read the story what are the three, or four questions that you consider important for this story?

P: Think about asking an expert about these stories.

Q6.2 Throughout this first part of the class, you have learned about four biblical criticism methods used in gospel interpretation: feminist, narrative, historical and redaction criticism. Which one of these four methods do you feel more comfortable to use? Why?

Q6.3 Here is a beginning of a map showing the four methods and three more concepts: meaning, truth, and Daily Intelligencer the computer environment you used in this course. **Please start with the method you feel more comfortable with and shortly analyze these two gospel texts.**

Please use Inspiration to complete the map as you explain your analysis. As you do your analysis **please think aloud...show your thinking.**

Now choose a second method you feel comfortable with and do a short analysis of the same gospel texts, but do not build another map, just tell about it.

When the student finishes:

Q6.3 Now, picture a map that has all four maps, one for each method. How do you see these four maps? Do they overlap all? Some overlap while others not? All of them will be independent? How do you see the relationship between what these four methods will tell about the same two gospel texts?

Computer environment (open the Daily Intelligencer (www.coe.missouri.edu/~danc04), and ask the student to login with own login info or with a guest password listed on the login page.)

Q7. Please login to the environment and look at the checklist.

What is your opinion (your take) about the non-gospel activities you were required to do (interview, training, staff writing)?

P: How helpful were these activities? Why?

Q8. Now, please go to the gospel training, final section. Open one of the examples.

What did you like and what did you dislike in this section?

P: Is it clear what you have to do?

How did you use it for your gospel assignment?

Q9. What will you improve in the gospel section to be more helpful for the next step, the gospel essay?

P: What would you change or add?

Q10. If a map like this (show the concept map for one method) will be available in a link, will it be helpful or confusing for you? Why?

P: How can we make it more useful for you?

Q11. Would be useful for you to have access to other jobs as you worked through your method?

P: If yes, where it should be available? Earlier, after you chose the job or later, closed to the exam?

Q12. Do you have any other suggestions related to the Daily Intelligencer that I did not cover in this interview?

Thank you for your time to participate in this interview!

New Testament – Experts Interview

Spring 2005

Intro protocol

Thank you for participating in this interview. First, I will like to remind you that your participation is completely voluntarily and that there are no anticipated risks or discomforts. You have the right to withdraw at any time with no repercussions. Second, your responses are completely confidential as stated in the informed consent statement. As you can see, I assigned an interview code to all outputs of this interview.

I am interested in an expert perspective on several activities related to the biblical criticism methods and the associated online learning environment associated with the gospel part of the Intro to New Testament course.

Warm up questions

Q1. How would you define religion studies?

P: Is there an academic definition of religious studies and a non-academic one?

Q2. What changes in students' understanding of Religion would you expect after the Gospel part of the course?

P: Can you indicate what variance in this change do you expect?

Computer environment

Q3. What is your perception about the impact of the computer environment on students' learning and motivation?

Q4. What would you change or add to the current form of the environment to make it more useful for your students?

Conceptual understanding questions

Q5. (Use C-map environment – - <http://www.coe.missouri.edu/~danc04/cmap/>). On the screen you have 36 concepts related to a higher or lower degree to the topic of your class – gospel analysis. These concepts are randomly displayed on the screen. Take 2 to 3 minutes to get familiar with the environment. ... Now please group them based on their similarity. As you move them **please think aloud...show your thinking, your question marks (if any), your frustrations.**

P (*if long silence periods occur*):

Why did you choose these concepts as part of this group? Can you tell me what are you doing or thinking? Do you have any doubts about this choice? Why?

P: (*After the map was finished*) Now that you finished it, can you describe what this map is telling you? How would you read this map?

Q6. Please take 2 minutes and read these two gospel stories (Mark and Matt)

Q6.1 From an expert perspective what are the three or four important questions and what are three or four trivial questions that a student could ask after reading these stories?

Q6.2 Here is a beginning of a map showing the four methods and three more concepts: meaning, truth, and Daily Intelligencer, your computer environment.

Please start with one of the methods and shortly analyze the two gospel texts. Next choose one of the other methods to cover all four of them.

Please use Inspiration to complete the map as you explain your analysis. As you do your analysis **please think aloud...show your thinking.**

Q7. (Use Inspiration map). On the first page you have 36 concepts related to a higher or lower degree to the topic of your class – gospel analysis. They are randomly placed on three columns. Three of them are crossed out and they appear on the second page and on the computer screen as the starting point for a concept map. Please place all the remaining words on the map. Once you used a word, please cross it out in the original list.

As you move them **please think aloud...show your thinking, your question marks (if any), your frustrations.**

P (if long silence periods occur):

Why did you choose these concepts as part of this group? Can you tell me what are you doing or thinking? Do you have any doubts about this choice? Why?

P: (After the map was finished) Now that you finished it, can you describe what this map is telling you? How would you read this map?

Thank you!

The Impact of a Computer-Based Learning Environment on Students' Conceptual Understanding of Biblical Criticism Methods

Informed Consent Statement – Student Individual Interview

The purpose of this study is to examine the implementation of a computerized learning environment to determine how to most effectively integrate this environment into a New Testament large course. For this stage of the study, we request your participation in an individual open-ended interview regarding your perceptions of the value of the computer-based learning environment (implemented in your class) and its impact on your conceptual understanding of the biblical criticism methods. The interview will take approximately one hour of your time.

While the interview involves minimal risk to you, the following procedures will be taken to protect you against all risks:

1. Your participation in this interview is completely **voluntary**. There are no anticipated risks or discomforts related to your participation.
2. Because this interview **will benefit you** by engaging in reflection on your understanding of the biblical criticism methods, and also will benefit future students of this course, your instructor will award you 10 (ten) extra-points upon my confirmation of your completion of the interview.
3. You have **the right to withdraw** from the study any time with no question asked and **no repercussions**. Your decision to withdraw from this interview **will not affect your grade in any way**. If you decide to withdraw, you still have the opportunity to obtain the same number of extra-points by completing a second job in the online environment.
4. You have the right to refuse to answer any questions uncomfortable to you during the interview.
5. All participant responses will be **completely confidential**. Your responses made during the interview will be available only to the researcher. Your name and identifying information will not be used in reports based on this research study. Participants will not be identified in any presentation or publication resulting from this research. Data files for each participant will be set up with an alpha-numerical code so that no identities are revealed. Data will be stored in locked project files and password-secured computer analysis files by the researcher. Audio interviews will be transcribed and the original tapes and/or audio digital files saved on CDs will be stored in locked project files. Any personal comments of yours that the researchers wish to share in reports, manuscripts, or presentations will be assigned to a pseudonym to protect your identity. All records will be destroyed three years following the close of the research.
6. Your permission is requested to allow the interview results to be used in the researcher's doctoral dissertation as well as in presentations at professional conferences and printed professional publications.

If you have any questions about this research or your participation, now or at any time, please feel free to contact:

Dan Cernusca., School of Information Science and Learning Technologies
111 London Hall
(573) 884 2737
dcwt2@mizzou.edu

For additional information regarding human participation in research, please feel free to contact UMC Campus IRB Office at (573) 882-9585.

If you understand the request and:

- voluntarily agree to participate in this study;
- allow these results to be used for the research purposes stated in this consent;

then write the following and submit the statement. your name; ____ your student ID ____; date ____

Screenshot from C-Mapper interface with the 36 randomly placed concepts
(Used with Q5.1 for students and Q5 for experts)



List of random words and the startup Inspiration map (Used with Q5.2 for students and Q7 for experts)

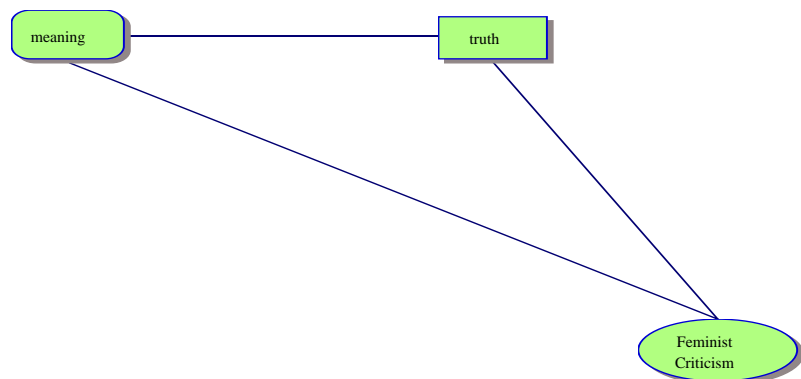
Interview 2005w _____ Date _____

John	church ¹	personal beliefs ¹
single source	causality ¹	Mathew
multiple attestation	narrative criticism	conflict resolution
redaction criticism	liberation	dogmatic interpretation ¹
redactor's social situation	composition	embarrassment
synoptic gospels	distinctiveness	cover
academic interpretation ¹	family	context ¹
opponents	certainty	feminist criticism
historical criticism	Mark	faith ¹
main character	truth ¹	school ¹
Luke	danger	two sources hypothesis
meaning ¹	authentic version	allies

¹ Generic concepts that were not part of the structure of the four biblical criticism methods used in online activity

Interview:2005w _____

Date _____



Gospel Texts to analyze

(Q6 for both students and experts)

Interview: 2005w_____

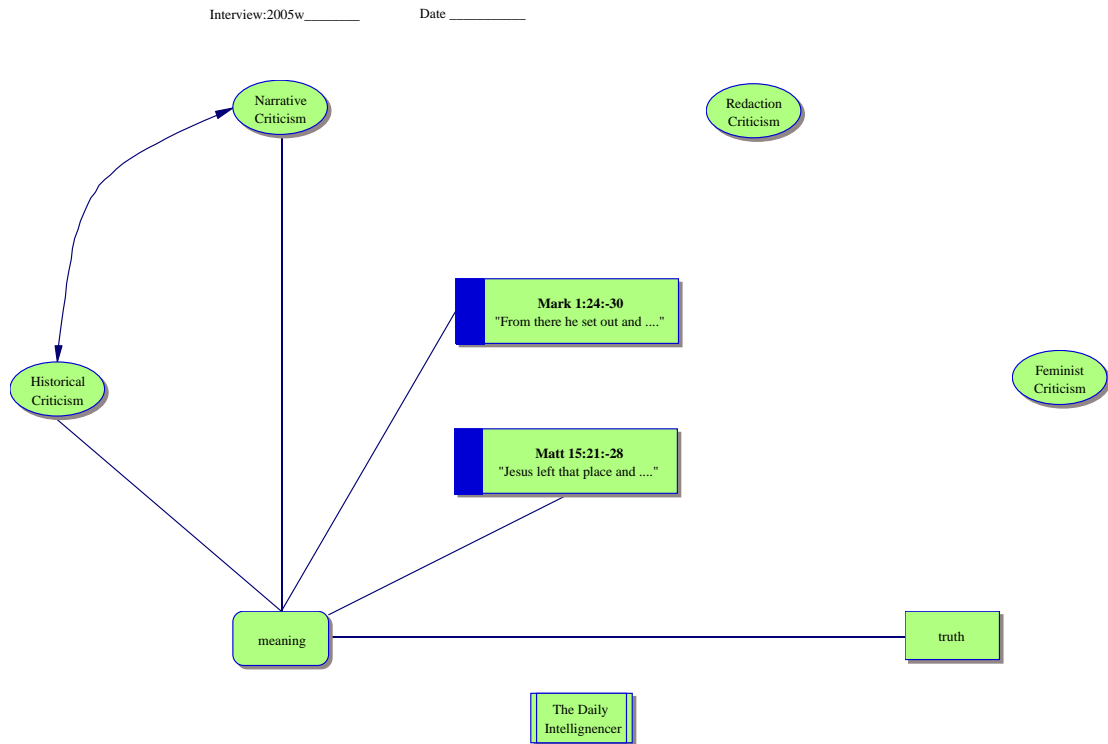
Mark 7:24-30.

From there he set out and went away to the region of Tyre. He entered a house and did not want anyone to know he was there. Yet he could not escape notice, but a woman whose little daughter had an unclean spirit immediately heard about him, and she came and bowed down at his feet. Now the woman was a Gentile, of Syrophenician origin. She begged him to cast the demon out of her daughter. He said to her, "Let the children be fed first, for it is not fair to take the children's food and throw it to the dogs." But she answered him, "Sir, even the dogs under the table eat the children's crumbs." Then he said to her, "For saying that, you may go-the demon has left your daughter." So she went home, found the child lying on the bed, and the demon gone.

Matthew 15:21-28.

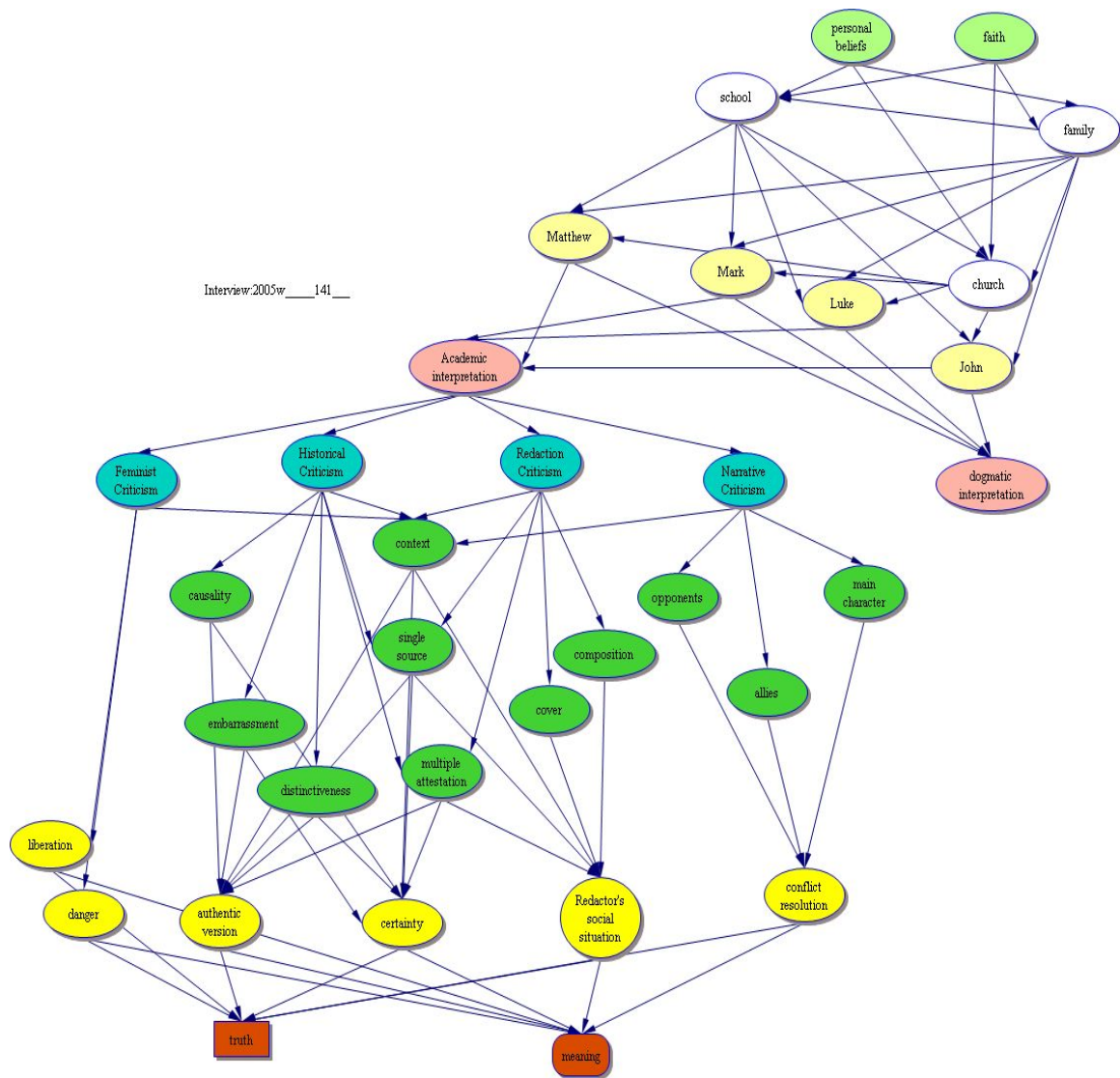
Jesus left that place and went away to the district of Tyre and Sidon. Just then a Canaanite woman from that region came out and started shouting, "Have mercy on me, Lord, Son of David; my daughter is tormented by a demon." But he did not answer her at all. And his disciples came and urged him, saying, "Send her away, for she keeps shouting after us." He answered, "I was sent only to the lost sheep of the house of Israel." But she came and knelt before him, saying, "Lord, help me." He answered, "It is not fair to take the children's food and throw it to the dogs." She said, "Yes, Lord, yet even the dogs eat the crumbs that fall from their masters' table." Then Jesus answered her, "Woman, great is your faith! Let it be done for you as you wish." And her daughter was healed instantly.

Inspiration concept map presented as starting point for text interpretation
(Q6 for both students and experts)

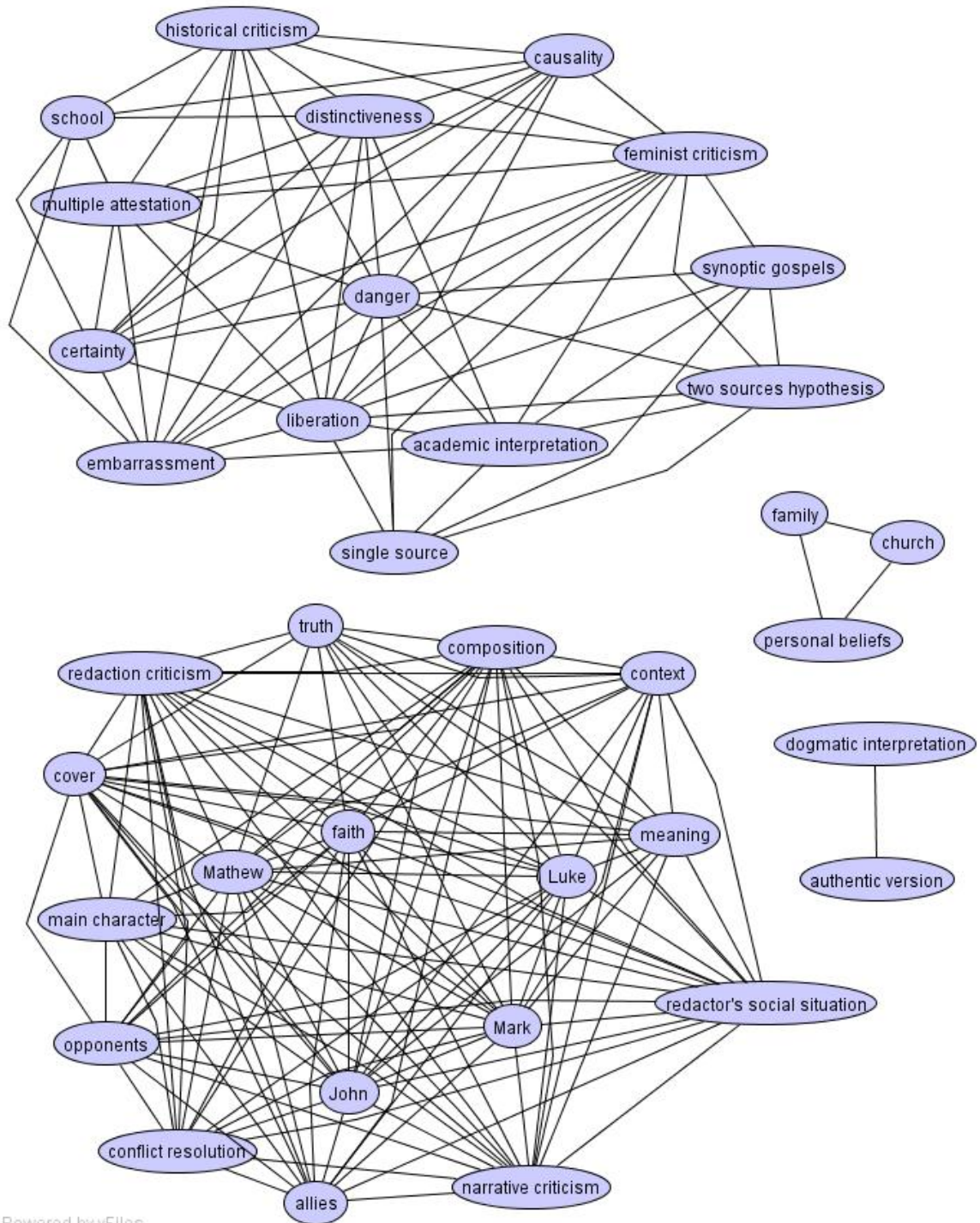


APPENDIX I

Instructor's Inspiration map for free association task

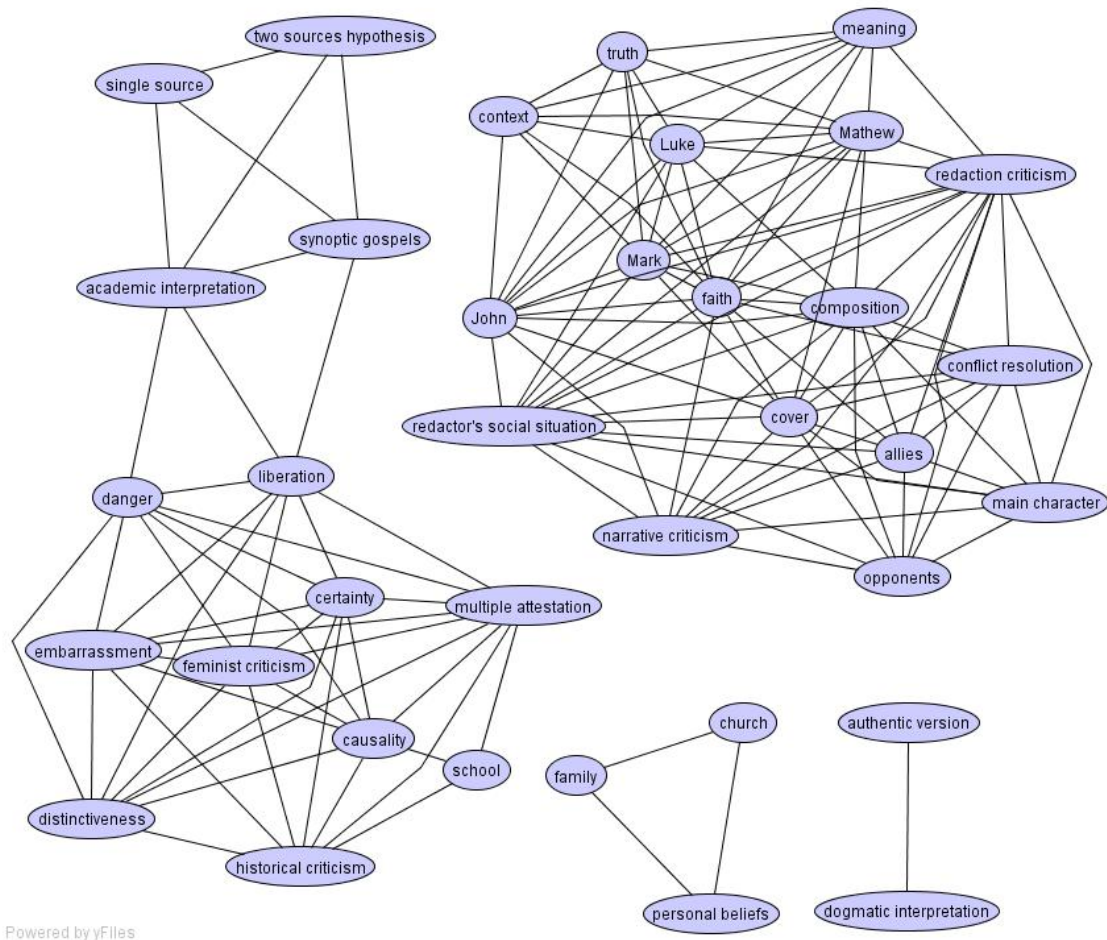


Instructor's structural network for $c = .3$

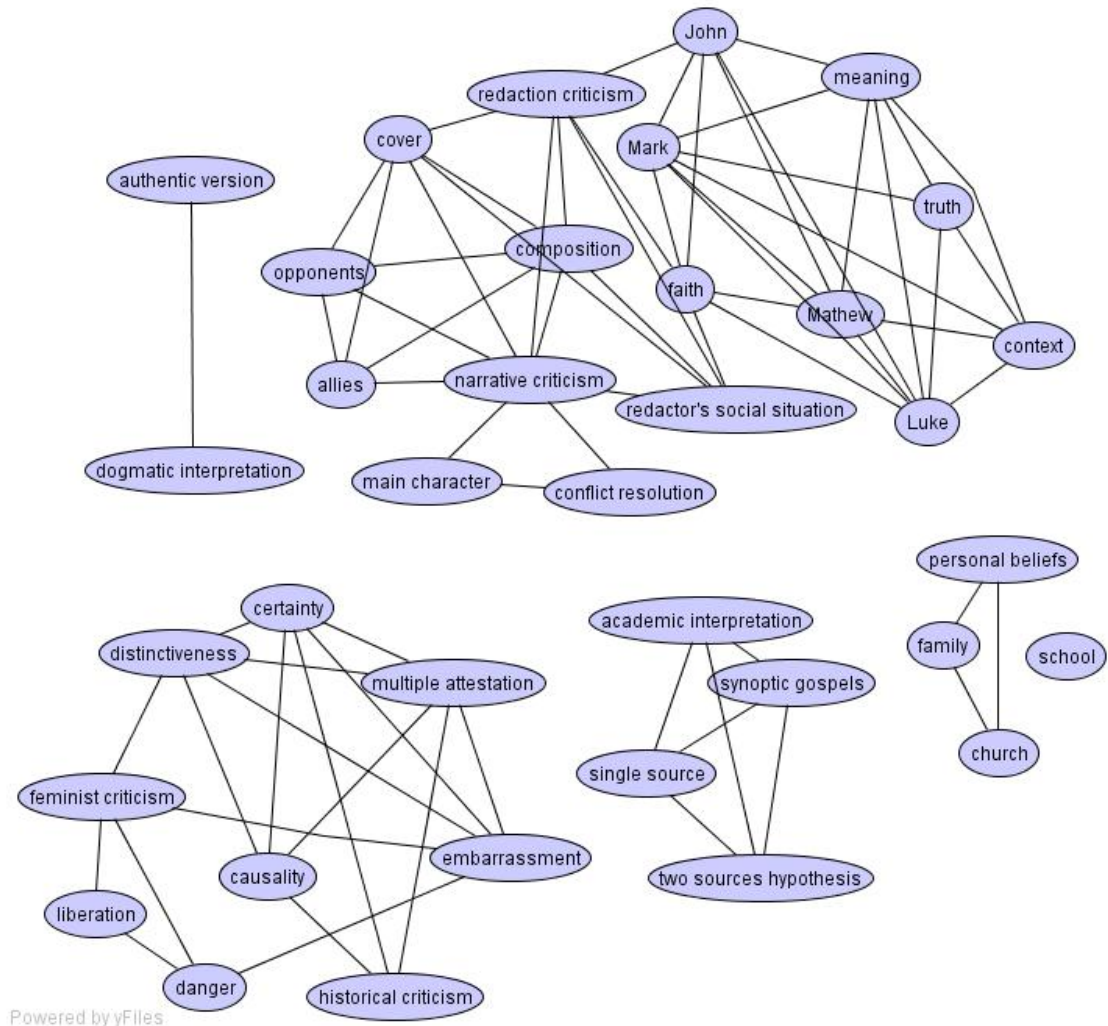


Powered by yFiles

Instructor's structural network for $c = .2$

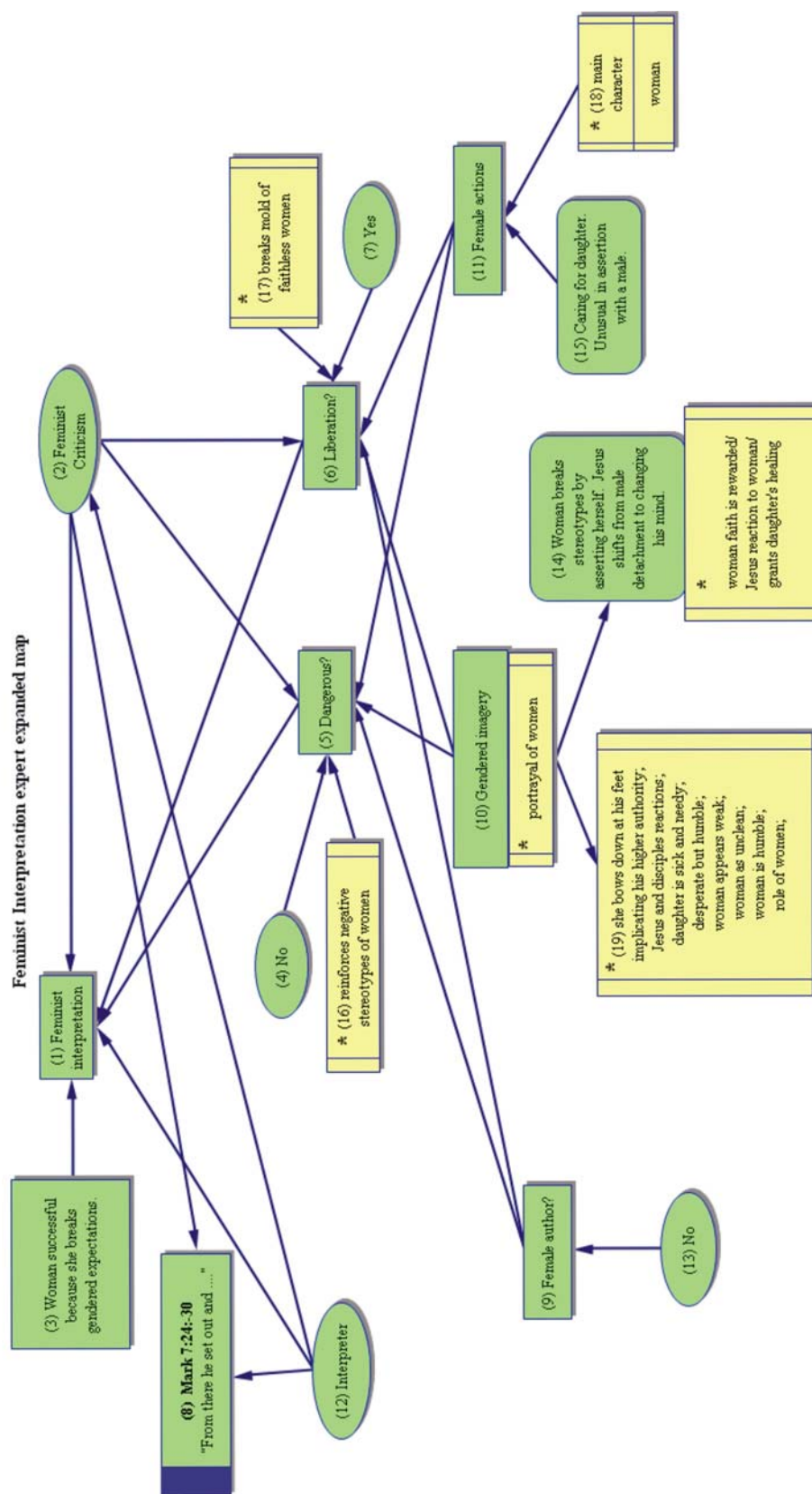


Instructor's structural network for $c = .1$



APPENDIX J

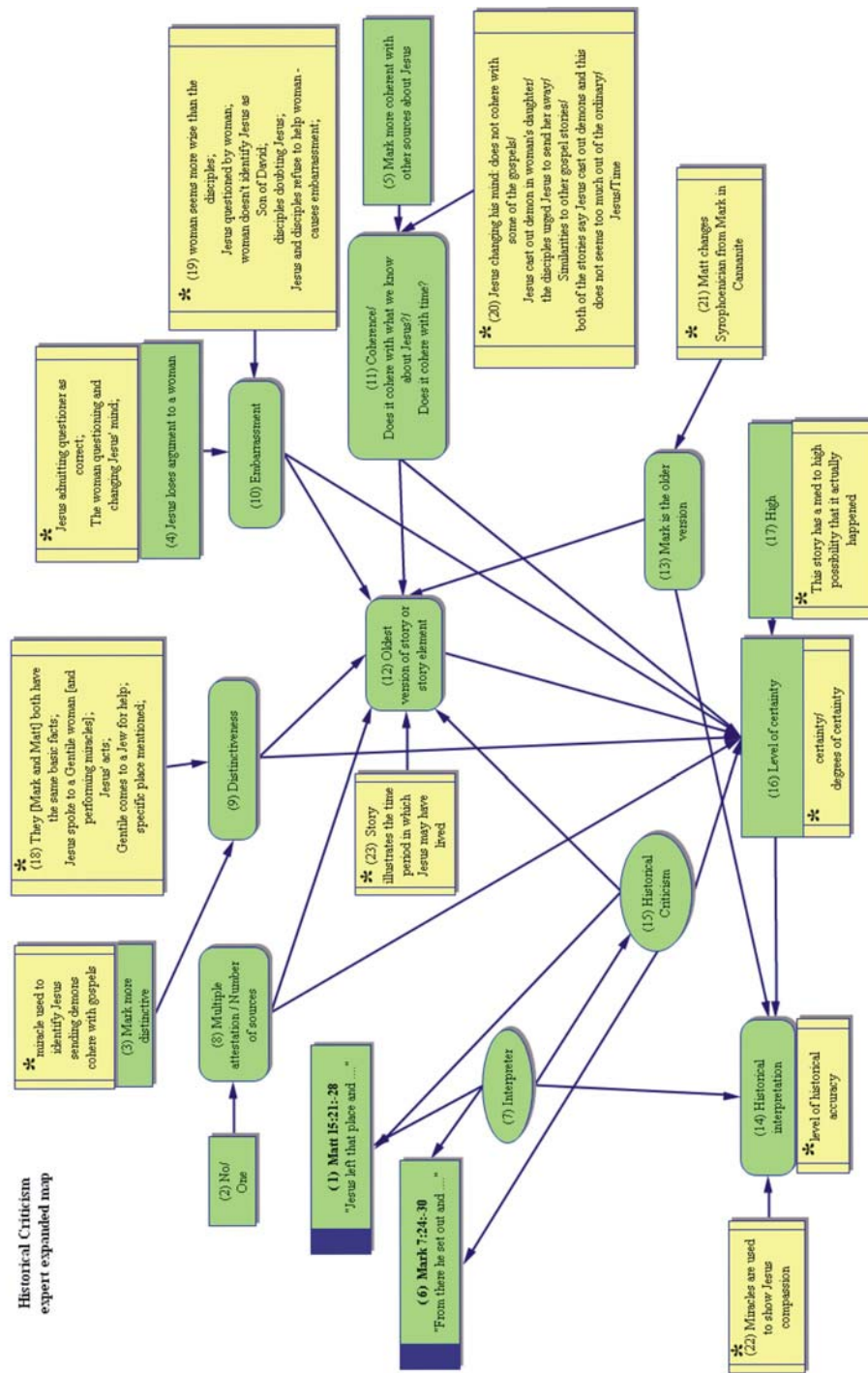
Expert expanded map: Feminist Criticism



* Concepts from students' concept maps considered by the instructor equivalent to his ones

APPENDIX J

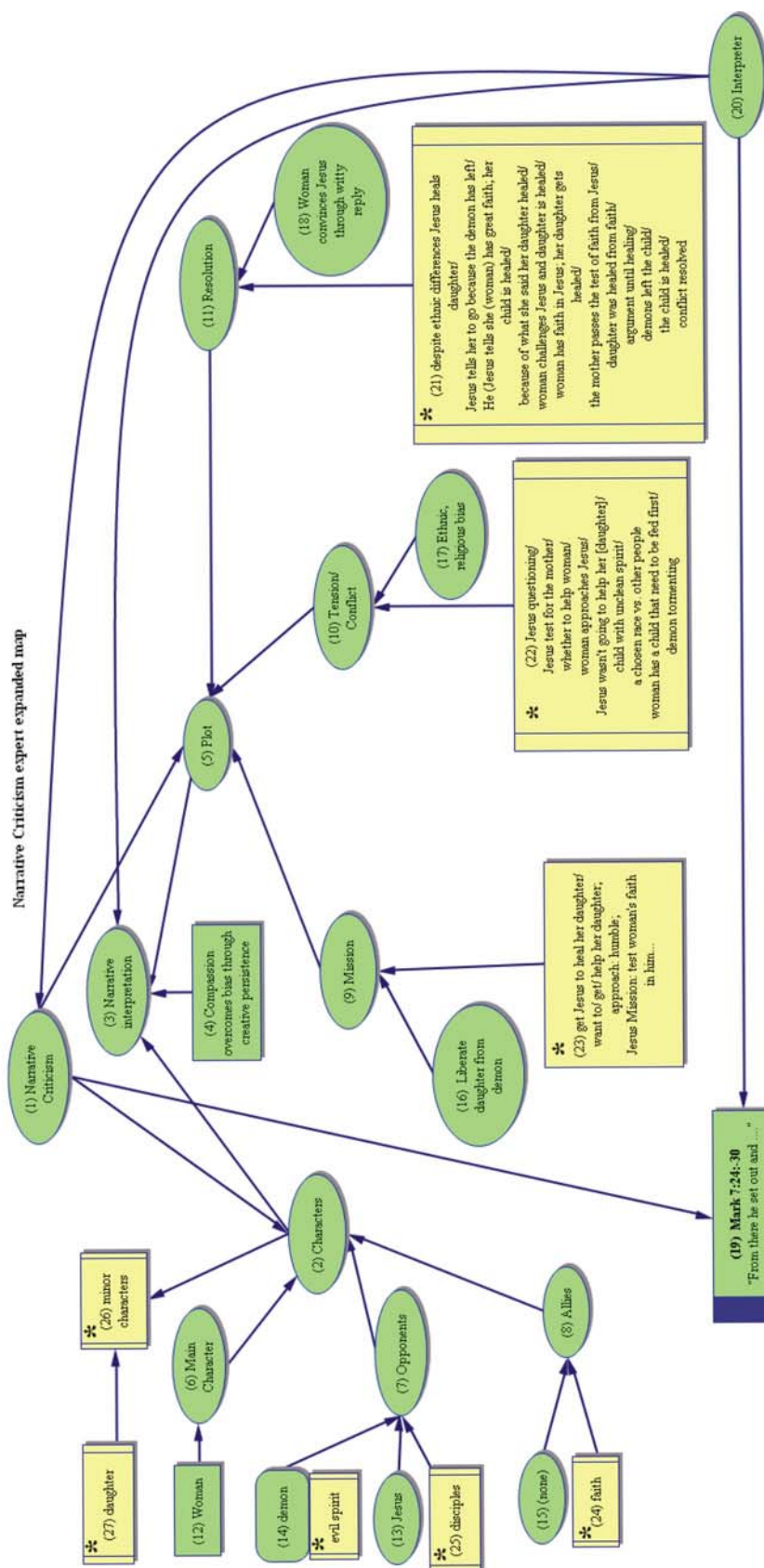
Expert expanded map: Historical Criticism



* Concepts from students' concept maps considered by the instructor equivalent to his ones

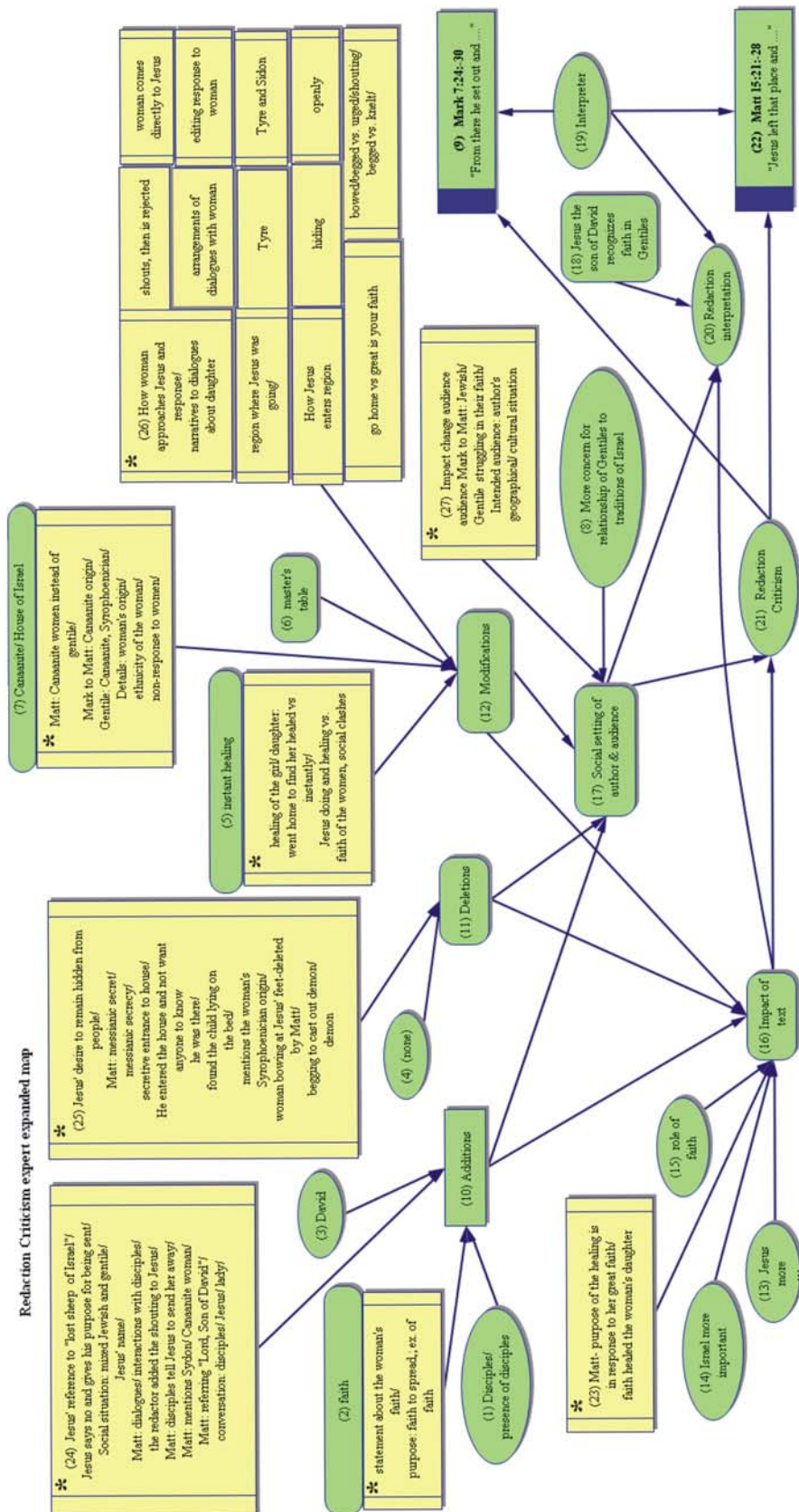
APPENDIX J

Expert expanded map: Narrative Criticism



APPENDIX J

Expert expanded map: Narrative Criticism



* Concepts from students' concept maps considered by the instructor equivalent to his ones

APPENDIX K

Analysis of Variance for the Diversity Measures Used in the Exit Interview

Source	<i>df</i>	F	η^2	Observed Power
Distance Da				
Between subjects				
Education level	2	.08	.004	.061
Error	35	(.001)		
Major	3	.53	.045	.147
Error	34	(.02)		
Epistemic Beliefs	1	.98	.027	.162
Error	36	(.02)		
Distance Dm				
Between subjects				
Education level	2	.03	.002	.054
Error	35	(.017)		
Major	3	.76	.063	.194
Error	34	(.016)		
Epistemic Beliefs	1	.40	.020	.133
Error	36	(.016)		
Distance Di				
Between subjects				
Education level	2	1.36	.072	.274
Error	35	(.014)		
Major	3	1.17	.093	.285
Error	34	(.014)		
Epistemic Beliefs	1	2.69	.070	.359
Error	36	(.013)		

Notes: Values enclosed in parentheses represent mean square errors

Analysis of Variance for the Diversity Measures Used in the Exit Interview-continuing

Source	<i>df</i>	F	η^2	Observed Power
Agreement AGa				
Between subjects				
Education level	2	.40	.023	.110
Error	35	(.005)		
Major	3	.79	.065	.201
Error	34	(.005)		
Epistemic Beliefs	1	2.92	.075	.383
Error	36	(.004)		
Agreement AGm				
Between subjects				
Education level	2	.13	.007	.068
Error	35	(.007)		
Major	3	.45	.038	.131
Error	34	(.007)		
Epistemic Beliefs	1	1.54	.041	.227
Error	36	(.007)		
Agreement AGi				
Between subjects				
Education level	2	.82	.045	.178
Error	35	(.009)		
Major	3	1.34	.106	.325
Error	34	(.009)		
Epistemic Beliefs	1	1.03	.028	.167
Error	36	(.009)		

Notes: Values enclosed in parentheses represent mean square errors

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In August 2001 Dan returned to the University of Missouri-Columbia at which he graduated with a PhD in Information Sciences and Learning Technologies in 2007. During his doctoral studies in Learning Technologies he participated in various research and development projects. He contributed to several research papers that were presented at national and international conferences or were published in peer-reviewed professional journals. Dan will start in August 2007 as Instructional Design Specialist in the Department of Distance and Continuing Education at the University of Missouri-Rolla.