PROMOTING EPISTEMOLOGICAL DEVELOPMENT
IN FIRST-YEAR COLLEGE STUDENTS
THROUGH INTERSUBJECTIVITY, SCAFFOLDING, AND PRACTICE

by
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<table>
<thead>
<tr>
<th>Human Development</th>
<th>5-21-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary L. Weckler</td>
<td>5-21-04</td>
</tr>
<tr>
<td>Samantha M. Jones</td>
<td>5-21-04</td>
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</tbody>
</table>

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Signed: Marcelle Kam
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DEDICATION

To Amy.

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an early blossom of sunflowers, passion flowers, and peonys

the perpetual blooming of baby’s breath, tuberose, geranium, holly, lisanthus, poppy, black-eyed susan, aster, and ivy

an eternal garden of jasmines, camellias, larkspurs, violets, pansies, and yellow tulips

Thank you.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>12</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>14</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>15</td>
</tr>
</tbody>
</table>

## CHAPTER I INTRODUCTION

Introduction of the Cognitive Development Intervention .................................................. 18
Definitions .................................................................................................................................. 18
  - Epistemological reflection ................................................................. 18
  - Epistemological development ............................................................... 18
  - Intersubjectivity ...................................................................................... 19
  - Reflective judgment .................................................................................. 19
  - Ill-structured problems ........................................................................... 19
  - Metacognitive awareness .......................................................................... 20
  - Program participation ............................................................................... 20
The Cognitive Development Intervention ............................................................... 20
Introduction of the Participants ......................................................................... 22
  - Paladins – Champions Fighting for a Cause ............................................ 22
  - The Importance of Paladins ...................................................................... 23
Introduction of The Paladins Project ................................................................. 23
  - The Importance of The Paladins Project .................................................. 23
Overview of The Paladins Project ........................................................................ 24
  - Step one – Execution of the pilot phase and refinement of evaluation techniques 25
  - Step two – Recruiting participants .......................................................... 25
  - Step three – Assigning participants to groups ......................................... 25
  - Step four – Training co-facilitators ......................................................... 25
  - Step five – Conducting introductory interviews ........................................ 26
  - Step six – Conducting the eight discussion sessions ............................... 26
  - Step seven – Administering questionnaires ............................................. 26
  - Step eight – Evaluation of the project ..................................................... 27

## CHAPTER II LITERATURE REVIEW

Theories and Models of Intellectual Development During College Years ................................. 29
  - The Definition of Development ............................................................... 29
  - Definition of ‘Process’ in the Cognitive Developmental Process ............... 30
Intersubjectivity ............................................................................................................ 31
  - Peer interactions ....................................................................................... 33
  - Task-related discussion ............................................................................ 33
  - Presence of differing viewpoints .............................................................. 34
  - Optimal balance in cognitive conflict ....................................................... 34
  - Openness and willingness to disagree ...................................................... 34
  - Constructive discourse features .............................................................. 35
TABLE OF CONTENTS – continued

Movement into Piagetian Formal Operations ........................................ 36
  Disequilibration, assimilation and accommodation, and equilibration .... 36
  The role of the plus-one concept in the process of development ........ 37
  Perspective-taking and formal operations ....................................... 38
  Extension of intersubjectivity beyond formal operations ..................... 39

The Perry Scheme of Intellectual Development .................................. 39
  The Scheme .................................................................................. 39
  Positions and Transitions .............................................................. 42
  The First Five Positions ............................................................... 43
    Position 1 ................................................................................. 44
    Position 2 ................................................................................. 45
    Position 3 ................................................................................. 46
    Position 4A ............................................................................... 47
    Position 4B ............................................................................... 49
    Position 5 ............................................................................... 51

Perry’s Three Broad Frameworks ......................................................... 52
  Dualism ....................................................................................... 52
  Multiplicity .................................................................................. 53
  Contextual relativism ..................................................................... 53

Developmental Concerns ................................................................... 53
  Discontinuity in movement ............................................................. 53
  Patterns of deflection or backwards movement .................................. 54
  Decalage or lateral movement .......................................................... 55
  Recursive nature of development or recapitulation in movement ...... 56

Kitchener and King’s Reflective Judgment Model ............................... 57

The Process of Transition Out of Each of the Reflective Judgment Stages 59
  Transition from stage 1 ................................................................. 60
  Transition from stage 2 ................................................................. 61
  Transition from stage 3 ................................................................. 61
  Transition from stage 4 ................................................................. 62
  Transition from stage 5 ................................................................. 62
  Transition from stage 6 ................................................................. 63
  Stage 7 ......................................................................................... 63

Ill-Structured Problems vs. Well-Structured Problems ....................... 64

The Reflective Judgment Interview ...................................................... 67
TABLE OF CONTENTS – continued

Empirically-Based Patterns of Epistemological Development ........................................ 70
  Sequentiality of stages ..................................................................................................... 70
  Consistency of stages across dilemmas ........................................................................... 72
  Associations with maturation and education .................................................................. 72
  Patterns from high school into college .......................................................................... 73
  Patterns among first-year students ................................................................................ 74
  Patterns among college students in general ...................................................................... 75
The Prototypic Reflective Judgment Interview ................................................................. 76
  The PRJI method ............................................................................................................. 76
  Scaffolding and practice ................................................................................................. 77
  Empirically-based patterns of development with scaffolding and practice ...................... 78
Kitchener's Three-Level Model of Cognitive Processing .................................................. 80
  The Three Levels ........................................................................................................... 81
    Cognition ...................................................................................................................... 81
    Metacognition .............................................................................................................. 81
    Epistemic cognition ..................................................................................................... 81
The Role of Metacognition in Epistemological Development ........................................... 82
  Metacognitive Awareness ............................................................................................... 83
Research Questions ........................................................................................................... 84

CHAPTER III METHODS .................................................................................................... 88
Sample ............................................................................................................................... 88
  Criteria for Inclusion ...................................................................................................... 88
  Recruitment Procedure ................................................................................................. 88
  Sample Description ........................................................................................................ 90
Design ................................................................................................................................ 90
  Training Co-Facilitators ................................................................................................. 91
  July Pre-Test Measurement Administration ................................................................... 92
  Group Assignment ......................................................................................................... 92
  Introductory Interview .................................................................................................. 93
  Discussion Sessions One through Five ........................................................................... 93
  Discussion Session Six – Cognitive Development Intervention Discussion about the effects of chemical additives on foods ................................................................. 95
  Discussion Session Seven – Cognitive Development Intervention Discussion about the construction of the pyramids .............................................................................. 98
  Discussion Session Eight ............................................................................................... 99
  December Post-Test Measurement Administration .................................................... 100
  March Follow-Up Measurement Administration ........................................................ 100
### TABLE OF CONTENTS – continued

<table>
<thead>
<tr>
<th>Measures</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic Measures</td>
<td>100</td>
</tr>
<tr>
<td>Epistemological Reflection</td>
<td>101</td>
</tr>
<tr>
<td>Intersubjectivity</td>
<td>106</td>
</tr>
<tr>
<td>Intersubjective Milieu</td>
<td>108</td>
</tr>
<tr>
<td>Metacognitive Awareness</td>
<td>109</td>
</tr>
<tr>
<td>Plan of Analysis</td>
<td>110</td>
</tr>
<tr>
<td>Research Question 1</td>
<td>110</td>
</tr>
<tr>
<td>Research Question 2</td>
<td>111</td>
</tr>
<tr>
<td>Research Question 3</td>
<td>111</td>
</tr>
<tr>
<td>Research Question 4a</td>
<td>111</td>
</tr>
<tr>
<td>Research Question 4b</td>
<td>112</td>
</tr>
<tr>
<td>Research Question 4c</td>
<td>112</td>
</tr>
<tr>
<td>Post-test analysis</td>
<td>113</td>
</tr>
<tr>
<td>Follow-up analysis</td>
<td>113</td>
</tr>
<tr>
<td>Research Question 5a</td>
<td>114</td>
</tr>
<tr>
<td>Post-test analysis</td>
<td>114</td>
</tr>
<tr>
<td>Follow-up analysis</td>
<td>115</td>
</tr>
<tr>
<td>Research Question 5b</td>
<td>116</td>
</tr>
<tr>
<td>Post-test analysis</td>
<td>116</td>
</tr>
<tr>
<td>Follow-up analysis</td>
<td>117</td>
</tr>
</tbody>
</table>

### CHAPTER IV RESULTS

<p>| Power Analysis                                                          | 118  |
| Sample Attrition                                                       | 118  |
| Description of the Variables                                           | 120  |
| Pre-test epistemological reflection                                    | 120  |
| Post-test epistemological reflection                                   | 121  |
| Follow-up epistemological reflection                                   | 121  |
| Metacognitive awareness                                                | 122  |
| Program participation rates                                            | 122  |
| Intersubjectivity                                                      | 122  |
| Intersubjective milieu                                                 | 123  |
| Intercorrelations                                                      | 124  |
| Pre-test and post-test epistemological reflection                      | 124  |
| Follow-up epistemological reflection                                   | 124  |
| Treatment variables                                                    | 125  |
| Intersubjectivity variables                                            | 125  |
| Mean intersubjectivity                                                 | 126  |
| Domains within the Measure of Epistemological Development              | 126  |</p>
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS – continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Questions ........................ 128</td>
</tr>
<tr>
<td>Research Question 1 Results ................ 128</td>
</tr>
<tr>
<td>Research Question 2 Results ................ 129</td>
</tr>
<tr>
<td>Post-test Results ......................... 129</td>
</tr>
<tr>
<td>Follow-up Results ......................... 129</td>
</tr>
<tr>
<td>Research Question 3 Results .............. 129</td>
</tr>
<tr>
<td>Research Question 4a Results .............. 130</td>
</tr>
<tr>
<td>Research Question 4b Results .............. 130</td>
</tr>
<tr>
<td>Research Question 4c Results .............. 131</td>
</tr>
<tr>
<td>Post-test Results ......................... 131</td>
</tr>
<tr>
<td>Follow-up Results ......................... 131</td>
</tr>
<tr>
<td>Research Question 5a Results .............. 132</td>
</tr>
<tr>
<td>Research Question 5b Results .............. 133</td>
</tr>
<tr>
<td>Post Hoc Test to Uncover Patterns ........ 135</td>
</tr>
<tr>
<td>Statistical Tests .......................... 135</td>
</tr>
<tr>
<td>Regression and ANOVA tests ............... 135</td>
</tr>
<tr>
<td>Intersubjective milieu and program participation 136</td>
</tr>
<tr>
<td>Evaluation of Program Process ............ 136</td>
</tr>
<tr>
<td>Evaluation of Effects of Chemical Additives on Foods Session 136</td>
</tr>
<tr>
<td>Evaluation of Construction of the Pyramids Session 139</td>
</tr>
</tbody>
</table>

<p>| CHAPTER V DISCUSSION ....................... 142 |
| Rationale and Organization ................ 142 |
| Most Noteworthy Findings .................. 144 |
| The notable differences between the treatment and control groups 144 |
| The notable role of intersubjectivity in epistemological development 145 |
| The notable discovery of the role of metacognitive awareness 147 |
| Research Questions ......................... 148 |
| Discussion of research question 1 .......... 148 |
| Discussion of research question 2 .......... 149 |
| Discussion of research question 3 .......... 150 |
| Discussion of research question 4a .......... 151 |
| Discussion of research question 4b .......... 152 |
| Discussion of research question 4c .......... 153 |
| Discussion of research question 5a .......... 154 |
| Discussion of research question 5b .......... 155 |</p>
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical Contributions</td>
<td>156</td>
</tr>
<tr>
<td>The multi-directionality of development</td>
<td>156</td>
</tr>
<tr>
<td>Intersubjectivity is a change agent</td>
<td>158</td>
</tr>
<tr>
<td>Is stability evidence for positions or transitions?</td>
<td>159</td>
</tr>
<tr>
<td>Metacognitive awareness or metacognitive puzzlement?</td>
<td>160</td>
</tr>
<tr>
<td>Methodological Contributions</td>
<td>161</td>
</tr>
<tr>
<td>Measuring intersubjectivity</td>
<td>161</td>
</tr>
<tr>
<td>The Measure of Epistemological Development</td>
<td>162</td>
</tr>
<tr>
<td>Intervention Applications</td>
<td>163</td>
</tr>
<tr>
<td>Some Competing and Explanatory Hypotheses</td>
<td>166</td>
</tr>
<tr>
<td>Limitations</td>
<td>168</td>
</tr>
<tr>
<td>Future Directions</td>
<td>170</td>
</tr>
<tr>
<td>FOOTNOTE</td>
<td>176</td>
</tr>
<tr>
<td>TABLES</td>
<td>178</td>
</tr>
<tr>
<td>FIGURES</td>
<td>202</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>205</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>211</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>212</td>
</tr>
<tr>
<td>APPENDIX D</td>
<td>218</td>
</tr>
<tr>
<td>APPENDIX E</td>
<td>219</td>
</tr>
<tr>
<td>APPENDIX F</td>
<td>220</td>
</tr>
<tr>
<td>APPENDIX G</td>
<td>221</td>
</tr>
<tr>
<td>APPENDIX H</td>
<td>223</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>224</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1: Sample Demographics ........................................................................ 178
Table 2: Treatment and Control Group Demographics ................................ 179
Table 3: Treatment and Control Group Compositions (Gender, Ethnicity, Year and Major) ........................................................................ 180
Table 4: Descriptive Statistics for Pre-Test, Post-Test, Follow-Up Epistemological Reflection, and Metacognitive Awareness .......... 181
Table 5: Frequency Distribution of the Sample’s Pre-Test, Post-Test, and Follow-Up Epistemological Reflection Scores ................. 182
Table 6: Frequency Distribution of the Treatment Group’s Pre-Test, Post-Test, and Follow-Up Epistemological Reflection Scores .......... 183
Table 7: Frequency Distribution of the Control Group’s Pre-Test, Post-Test, and Follow-Up Epistemological Reflection Scores .......... 184
Table 8: Means and Standard Deviations for Pre-Test, Post-Test, and Follow-Up Epistemological Reflection, and Metacognitive Awareness by Condition ........................................................ 185
Table 9: Descriptive Statistics for Program Participation and Intersubjective Milieu ........................................................................ 186
Table 10: Descriptive Statistics for Intersubjectivity Ratings ....................... 187
Table 11: Descriptive Statistics for Treatment Participants’ Reports on Intersubjective Milieu ................................................................. 188
Table 12: Intercorrelations among Epistemological Reflection, Epistemological Development, Program Participation Rates, Intersubjective Milieu, and Metacognitive Awareness by Condition .................................................... 189
Table 13: Intercorrelations among Treatment Participants’ Participation Rates and Intersubjectivity Scores ............................................. 190
Table 14: Pre-Test to Post-Test Correlations among the Five Epistemological Reflection Domains ...................................................... 191
Table 15: Pre-Test to Follow-Up Correlations among the Five Epistemological Reflection Domains ............................... 192
Table 16: Post-Test to Follow-Up Correlations among the Five Epistemological Reflection Domains .............................................. 193
Table 17: Hierarchical Multiple Regression Model Testing Whether Intersubjectivity is a Moderator of Post-Test Epistemological Development ........................................................................... 194
Table 18: Hierarchical Multiple Regression Model Testing Whether Intersubjectivity is a Moderator of Follow-Up Epistemological Development ................................................................. 195
Table 19: Hierarchical Multiple Regression Model Testing Whether Metacognitive Awareness is a Moderator of Post-Test Epistemological Development ..................................................... 196
Table 20: Hierarchical Multiple Regression Model Testing Whether Metacognitive Awareness is a Moderator of Follow-Up Epistemological Development ................................................. 197
Table 21: Hierarchical Multiple Regression Model Exploring Whether Metacognitive Awareness is a Moderator of Post-Test Epistemological Development by Condition ......................... 198 & 199
Table 22: Hierarchical Multiple Regression Model Exploring Whether Metacognitive Awareness is a Moderator of Follow-Up Epistemological Development by Condition ......................... 200 & 201
LIST OF FIGURES

Figure 1: Change in epistemological reflection by condition .......................... 202
Figure 2: Moderating effect of intersubjectivity ....................................... 203
Figure 3: Moderating effect of metacognitive awareness by condition ........ 204
ABSTRACT

The study attempted to explore if epistemological development occurs among first-year college students and to untangle the process of that development by investigating the role of intersubjectivity and metacognitive awareness as mechanisms of change.

Epistemological development is an orderly sequence of five increasingly complex positions through which students reason about the nature of knowledge (Perry, 1970). Intersubjectivity is the cognitive developmental process whereby interacting peers who begin problem-solving tasks with different understandings arrive at shared understanding in the course of communication with each other (Tudge, 1992). Metacognitive awareness, the ability to facilitate the control aspect of cognition (Schraw & Dennison, 1994), may play an important role in the resolution of ill-structured problems (Kitchener, 1983).

Eighty-three participants (treatment $N = 50$; control $N = 33$) completed the Measure of Epistemological Development, an open-ended paper-and-pencil five-domain instrument which was created for this study (Baxter-Magolda, 1987; Moore, 1990) and administered at pre-test, post-test, and follow-up. The developmental process variables were measured by self-report intersubjectivity items (i.e., exposure to new forms of reasoning; adopted others’ reasoning) and the Metacognitive Awareness Inventory Regulation of Cognition Sub-Scale (Schraw & Dennison, 1994). Treatment group discussions about ill-structured problems were guided by seven probe questions.
(Kitchener & King, 1981), offered scaffolding and contextual support (Kitchener, Lynch, Fischer, & Wood, 1993), and ended with peers reaching agreement.

Epistemological reflection developed significantly between pre-test and follow-up ($t = -2.60, p < .01$). The control group changed little over time, while the treatment group slightly regressed from pre-test to post-test then developed significantly by follow-up $F(df = 2, 7.06, p < .01)$. Intersubjectivity moderated change in epistemological reflection between pre-test and follow-up ($R^2 = .645, p < .05$). Treatment participants who reported the lowest levels of intersubjectivity scored higher on follow-up epistemological reflection than all other treatment participants. Metacognitive awareness moderated change in epistemological reflection differentially for treatment and control participants. The unique effects of the metacognitive-awareness-by-condition interaction term and metacognitive awareness remained after the effects of pre-test epistemological reflection, metacognitive awareness, and the pre-test-by-metacognitive-awareness-by-condition interaction term were controlled statistically ($R^2 = .532, p < .05$).
CHAPTER I

INTRODUCTION

Intersubjectivity, defined as the process of arriving at shared understanding in the course of problem-solving communication with peers, is a theoretical cognitive developmental process construct that has only been investigated empirically during childhood (Tudge, 1989; Tudge, 1992; Tudge, Winterhoff, & Hogan, 1996). The present study will explore if the intersubjective process operates beyond formal operations into epistemological reflection among first-year college students. It will attempt to explain the role of intersubjectivity in the epistemological developmental process by assessing whether intersubjectivity moderates change in epistemological reflection. It will also extend our understanding of the effectiveness of intersubjectivity beyond dyadic interactions between children by applying it in a collegiate group-discussion setting. Theoretically, the development of epistemological reflection may also depend on participants' metacognitive awareness (Schraw & Dennison, 1994). This study will attempt to clarify if metacognitive awareness does indeed contribute to the epistemological developmental process and whether its effects can be demonstrated in addition to the effects of intersubjectivity.

Two theoretically-based empirical frontiers will be forged through the present study. The extant literature verifies the Perry scheme and the sequence of the Perry positions (Perry, 1970; Perry, 1981). First, the present study will initiate a new empirical direction because it will explore the generalizability of Perry's positions in a sample of under-represented first-year honors college students. Second, a new empirical direction
will be introduced by the utilization of the Prototypic Reflective Judgment Interview (PRJI) as a cognitive development intervention in a group-discussion format. Previous research with the PRJI assumed that adults are the conduits for the cognitive development of adolescents (Kitchener, Lynch, Fischer, & Wood, 1993). This study subscribes to the theoretical proposition that peers are quite effective at promoting one another's development (Azmitia & Perlmutter, 1989). The study will provide participants with the opportunity to engage in discussions with a group of peers and to practice more complex reasoning with other peers outside of the group discussion format.

Introduction of the Cognitive Development Intervention

Before the cognitive development intervention is introduced, it is important to first describe some important constructs that will provide a terminological foundation for understanding the description of the design of the present study and the theories that inform it.

Definitions

Epistemological reflection. Epistemological reflection is a pattern of thought or a reasoning structure (i.e., a stage of reasoning) concerning the understanding of the nature of knowledge (Perry, 1970). In the present study, it will be operationalized as an average stage score as assessed by the Measure of Epistemological Development, a measure developed for this study.

Epistemological development. The development of epistemological reflection to more sophisticated stages will be referred to as epistemological development. It will be operationalized as an increase from a lower pre-test epistemological reflection stage score
to a higher post-test epistemological reflection stage score as assessed by the Measure of Epistemological Development. In the research questions, it will be referred to as change in epistemological reflection.

**Intersubjectivity.** Intersubjectivity is the cognitive developmental process whereby interacting partners who begin a problem-solving task with different understandings arrive at a shared understanding in the course of communication with one another. These interacting peers jointly construct and share meaning through a cognitive, social, and emotional interchange that promotes more sophisticated reasoning (Tudge, 1992). In the present study, intersubjectivity will be operationalized as the degree of agreement between a) the reasoning participants perceive they have been exposed to and b) the reasoning participants perceive they will adopt and use as their own after reaching agreement with peers during the group discussion intervention.

**Reflective judgment.** Reflective judgment is a developmental sequence of seven increasingly complex assumptions about reality and the nature of knowledge, as well as corresponding concepts that are used to justify those assumptions (Kitchener & King, 1981). The sequence of reflective judgment stages will be presented to participants during the cognitive developmental intervention sessions to provide scaffolding as they learn how to reason at higher stages of epistemological reflection. It is anticipated that exposure to the reflective judgment stages will enhance participants' epistemological development.

**Ill-structured problems.** Ill-structured problems are dilemmas for which some of the solution parameters are unavailable or unknown and for which no effective
procedures (e.g., deductive or inductive) can guarantee a single correct solution. The most relevant facts in a contradiction, the path to solution, the potential outcomes, or the utility of potential outcomes is unknown or not known with a high degree of certainty (Kitchener & King, 1981). Two ill-structured problems will be presented to participants during the cognitive development intervention sessions to serve as the vehicle by which participants engage in intersubjective problem-solving discussions with peers.

*Metacognitive awareness.* Metacognitive awareness allows individuals to plan, sequence, and monitor their cognitions in a way that directly improves performance. The ability to facilitate the control aspect of cognition will be assessed in the present study by the Metacognitive Awareness Inventory Regulation of Cognition Subscale (Schraw & Dennison, 1994).

*Program participation.* Program participation will be the number of group discussion sessions attended by treatment participants. These attendance rates will be explored in conjunction with a six-item assessment of more *active* participation in conversations during discussion sessions.

*The Cognitive Development Intervention*

Two cognitive development intervention sessions have been designed to investigate the effect that intersubjective peer discussions of ill-structured problems have on epistemological development, when scaffolding (i.e., structured help in using more complex forms of reasoning) and practice at reasoning with these more sophisticated epistemologies are provided (Kitchener et al., 1993). The general design of the cognitive development intervention sessions involves introducing an ill-structured problem-solving
task to participants and encouraging them to disagree with each other during the session and, ultimately, to reach agreement through conversation.

At the beginning of each session, epistemological-reflection scaffolding is provided by introducing the seven stages of reflective judgment to participants, verbally and in writing. These introductory descriptions of each of the reflective judgment stages address key elements in reflective judgment thinking. Intellectual dilemmas (i.e., ill-structured problems) are then presented in semi-structured group-discussion format. Each dilemma is defined by two conflicting and contradictory points of view on an issue about which qualified experts often disagree and which represents an intellectual domain in an area that is intended to assure some generality. Participants are invited to think about the dilemma and the reflective judgment stages. After a few minutes of independent thought, each participant is encouraged to state and try to justify the most sophisticated stage of thinking s/he understands, as it applies to the dilemma. A standardized series of probe questions that elicit dilemma-specific statements regarding participants' most sophisticated epistemological views, in relation to the dilemma, guides the remainder of the discussion (Kitchener & King, 1981). The session concludes with a directive from the facilitator to the group in order to reach agreement on the most sophisticated point of view to take in thinking about the dilemma. Participants are encouraged to practice reasoning within each of the epistemologies with peers outside of the discussion group during the two-week period that lapses between the cognitive development intervention sessions. One month after the intervention has concluded, a post-test measure of epistemological development will be administered to examine if
developmental gains were exhibited by treatment participants.

*Introduction of the Participants*

*Paladins – Champions Fighting for a Cause*

All first-year undergraduates are at risk for poor academic adjustment as well as potential difficulty in persisting toward graduation (Tinto, 1988). Indeed, several subgroups of under-represented students have particularly bleak educational prospects. Youth of Hispanic origin are the majority of all students in their age group, representing 37.7% of the population under age 18 nationally, yet they are the least likely of all students to apply for admission to college (Hurtado, Inkelas, Briggs, & Rhee, 1997). For every one hundred Native American students who are in ninth grade, only about three will eventually receive a four-year degree (Tierney, 1992). Students whose high school curricula commonly preclude them from obtaining merit-based scholarships are disproportionately from rural regions. A disproportionate number of under-advantaged students are in the top 5% of their high school class and are receiving the best academic preparation available to them, yet they are not meeting colleges' honors admission criteria because their high schools' academic programs are relatively weak compared to non-at-risk honors students. Examination of the records of students (both honors and non-honors) who leave the University of Arizona because of attrition or academic disqualification indicates that these students are more likely to be minority students. In essence, despite demographic growth trends among minorities, there exists an under-representation of this population and other under-advantaged students in the educational pipeline. This situation is particularly acute in higher education (Zepeda, 2002).
There are more than 450 of these at risk first-year students (mean age = 19) attending The Honors College at the University of Arizona each year (this number does not include every first-year honors student). These students are true paladins (i.e., champions fighting against their odds for the cause of access to and success in higher education) because they apply and are admitted to an academically rigorous honors program at a large, four-year institution. However, these students typically do not have access to services that help them confront and overcome their difficulties. Nevertheless, our paladins seize the opportunity to take on more challenging programs than most college students.

**The Importance of Paladins**

Paladins are especially important because they are students who prevail and excel in the face of challenge. They show promise! The present study, which is part of a larger project designed and led by the author, will seek to understand how the reasoning of these students develops, while also examining factors that are believed to promote their cognitive development. The overarching purpose of this study is to promote these students' critical thinking skills, which in turn should enhance their academic success and optimize their potential to serve as productive citizens in our society. The broader Paladins Project will attempt to enhance these students' academic and social adjustment and retention rates, while facilitating their transition to university life.

**Introduction of The Paladins Project**

**The Importance of The Paladins Project**

The Paladins Project will serve as the vehicle through which the cognitive...
development intervention will be employed. In this section, an overview of the Paladins Project is given to illustrate the context in which the present study will take place.

Using parallel control groups, researchers have designed and empirically evaluated three different small-group intervention programs that aim to improve the prospects for first-year students' adaptation during their transition to university life (Lamothe et al., 1995; Oppenheimer, 1984; Pratt et al., 2000). All three programs provide empirical evidence that first-year students who engage in small group discussions which are geared to enhancing perceived social support, show improved adjustment, which in turn impacts academic outcomes and the likelihood of obtaining a degree. In contrast, first-year students in control groups do not show evidence of similar gains (Pratt et al., 2000). The Paladins Project is a support program designed to build on the earlier research by Oppenheimer (1984) and Lamothe and colleagues (1995) and extend Pratt and colleagues' (2000) findings to honors students who are from under-represented and under-advantaged populations. While the larger Paladins Project is a program that measures adjustment and assesses the associations between support program goals and retention rates, the present study will focus specifically on investigating the effects of an intervention that is intended to facilitate the cognitive developmental process and, thus, promote cognitive development.

Overview of The Paladins Project

The methodological components of the larger Paladins Project are extended from the research done by Pratt and colleagues (2000), have already been piloted with a group of eight at-risk honors students during the 2002-2003 academic year, and have been
approved by the University of Arizona Social and Behavioral Sciences Human Subjects Committee. Components that pertain directly to the assessment of the cognitive developmental process in the present study were submitted to the Human Subjects Committee upon approval by the dissertation committee. The following is a summary of the methodological activities of The Paladins Project. A more specific delineation of these methods within the context of the present study of the cognitive developmental process, appears in Chapter Three.

Step one - Execution of pilot phase and refinement of evaluation techniques. The Honors College piloted the group-discussion and quantitative and qualitative questionnaire portions of the intervention during the 2002-2003 academic year with a set of eight at-risk first-year honors students. The pilot phase demonstrated the appropriateness of the study and highlighted minor areas where modifications needed to be made to improve procedures and measures.

Step two - Recruiting participants. An introductory letter, consent form, tentative schedule, and questionnaire were mailed in July of 2003 to all students who met selection criteria ($N = 472$).

Step three - Assigning participants to groups. Individuals who returned completed consent forms and questionnaires were assigned quasi-randomly either to an 8- to 12-person intervention discussion group ($N = 51$) or the questionnaire-only control group ($N = 32$).

Step four - Training co-facilitators. Two facilitators were assigned to each discussion group (i.e., the author and one undergraduate co-facilitator). All co-
facilitators were asked to read and subsequently discuss materials related to active listening and interviewing skills before the group discussion sessions commenced. Training was devoted to detailed discussion of reading materials, facilitators' roles, and discussion-session tasks. In addition, co-facilitators had an opportunity to actively lead mock discussions and play the role of group members during the training sessions.

*Step five - Conducting introductory interviews.* Each participant who was assigned to a discussion group met with the author for 10-15 minutes during the first week of classes at a time that was convenient for the participant. The brief interview provided participants with an opportunity to meet their lead facilitator and discuss their concerns, hopes, and Paladins-related aspirations.

*Step six - Conducting the eight discussion sessions.* For eight weeks during the Fall semester of 2003 (weekly for the first four weeks; biweekly through the remainder of the semester), topic-specific group discussions took place. Sessions lasted approximately 90 minutes, began with a short check-in, followed by an exercise that was focused on the day's topic, a more open discussion, a pencil-and-paper evaluation of the session, and a wrap-up and brief introduction of the next session. The sequence of eight discussion topics was as follows: introduction, new social ties, balancing work and social life, personal values and peer pressure, academic expectations and reality, two cognitive development intervention sessions, and previous social ties/getting ready to return home for Thanksgiving.

*Step seven - Administering questionnaires.* The pre-test questionnaires were mailed in July of 2003. Post-participation questionnaires were administered to treatment
and control participants in December of 2003 and March of 2004.

Step eight - Evaluation of the project. During the Spring semester of 2004, an outcome evaluation of program effectiveness was employed to compare participants' and control students' responses to survey questionnaires and to investigate significant group differences in academic outcomes, academic and social adjustment, cognitive development, and retention rates. Follow-up questionnaires were analyzed in March of the students' first year to assess whether its effects were lasting. Responses were compared between treatment and control groups, across time. Process evaluation was based upon attendance records and facilitator evaluations to determine if the intended methods were used and the objectives were met. The process evaluation was also used to determine if discussions provided suitable conditions to promote engaged intellectual conversation. Follow-up qualitative interviews with a subset of the participants was conducted to explore why the program was or was not effective and which aspects of the program mattered most to participants.

The present study of the cognitive developmental process aims to determine whether five broad empirical relationships exist:

1. Whether epistemological reflection develops during the first year of college among at-risk honors students, to a greater extent among treatment participants, and particularly for those treatment participants who have higher participation rates.

2. Whether intersubjectivity takes place for participants during the peer pressure, academic expectations, and cognitive development intervention sessions, especially for those participants who have higher participation rates.
3. Whether intersubjectivity moderates change in epistemological reflection.

4. Whether change in epistemological reflection is moderated by either intersubjectivity, or metacognition, or both together.

5. Whether metacognition differentially moderates change in epistemological reflection for treatment versus control participants.
CHAPTER II
LITERATURE REVIEW

The work in this dissertation is deeply rooted in theory. This chapter presents a detailed explanation of the theories which informed the design of the study and the selection of the measures. It will begin with a description of the main principles of developmental theory and the mechanisms involved in the cognitive developmental process. This conceptual foundation will be followed by a description of two theories of cognitive development. First, a portrait of the stage-like trajectory of epistemological development during late adolescence/early adulthood and possible deflections from this trajectory will be identified through Perry’s (1970) scheme of intellectual development. Then, a more specific delineation of the process of cognitive development through the stages and empirical evidence demonstrating this progression will be chronicled through Kitchener and King’s (1981) reflective judgment model. In this section, an account of a set of theoretically-based empirical works that have tested the validity of the stages and assessed potential mechanisms that promote development will also be given. The chapter will end with a description of the potential role of metacognition in cognitive processing and epistemological development during the college years.

Theories and Models of Intellectual Development During the College Years

The Definition of Development

A number of criteria have been proposed to distinguish between developmental change and non-developmental change. Though there is not a clear answer to the question of what kind of intraindividual (i.e., within-person) change should be labeled
development; Baltes, Reese, and Nesselroade (1988) propose that development is movement over time toward complexity of organization, hierarchization, the incorporation of parts or part-systems into larger units or wholes, and teleos or an endstate of organization.

To classify change as developmental, it must be lasting, not temporary. Phenomena that merely temporarily change are too easily alterable and may be largely controlled by concurrent situational determinants. Thus, not all time-related intraindividual changes are developmental (Baltes et al., 1988). Conversely, developing phenomena endure over time until they are transformed to yet another more complex level of organization (Baltes et al., 1988). The theories that will be applied in this study endorse all of these assumptions about development. This study will assess the degree to which first-year college students develop in their epistemological reflection and the extent to which change in epistemological reflection endures over the course of the first year of college, in order to determine whether there has been developmental change.

Definition of ’Process’ in the Cognitive Developmental Process

A process is a course of action (Oxford University Press, 1996). In the case of epistemological development, the process is the mechanism or course of action by which reasoning about the nature of knowledge is believed to move toward a new level of complexity of organization and hierarchization. This chapter will describe aspects of relevant theories that describe the process by which college students progress to increasingly complex levels of organization in their epistemological reflection. The present study will include an intervention component that is intended to facilitate this
process and a corresponding measure of the process.

**Inter-subjectivity**

The process which pertains to cognitive development is referred to as intersubjectivity. Intersubjectivity is the process whereby interacting partners who begin a problem-solving task with different understandings of it arrive at shared understanding in the course of communication with each other (Tudge, 1992; Vygotsky, 1978). These interacting partners jointly construct and share meaning through a cognitive, social, and emotional interchange that promotes more sophisticated reasoning (Gauvain, 2001).

Intersubjectivity has been investigated empirically only in observational studies of the impact of peer interactions on children's cognitive development (Tudge, 1989; Tudge, 1992; Tudge et al., 1996). The standard design comprises a sample of children between 5 and 9 years of age who are individually pre-tested on their rule-based thinking. In the paradigm used in these studies, *rules* are believed to be applied by children to predict the movement of a balance beam when different numbers of weights are placed at varying distances from the fulcrum. Seven rules to solving the well-structured balance beam problem have been reliably identified, ranging from simple guesswork, with no consistent attempt to consider either number of weights or distance to the fulcrum, to the ability to predict precisely what will happen when any configuration of weights is placed on the beam. Each successive rule demonstrates thinking that deals with relevant variables (i.e., number of weights and their distance from the fulcrum) in an increasingly sophisticated way than previous rules. Several days after the pre-test procedure is employed to assess children's initial independent levels of reasoning, the children are
grouped into three treatment conditions on the basis of their initial rules. The control
group is comprised of children who do not work with a partner. The equal rule
group consists of pairs of children who used the same rule at pre-test. The unequal rule group
is composed of pairs of children who used different rules at pre-test (Tudge, 1989; Tudge,
1992; Tudge et al., 1996).

In the treatment phase, members of pairs are instructed to take turns to be the first
to predict movement of the beam on seven different problem configurations. After both
partners make predictions, they are instructed to justify their predictions and discuss their
reasons until they reach agreement on one prediction. The interactions that transpire
during this treatment phase are either audiotaped or videotaped and then coded. In this
empirical work, intersubjectivity is operationally defined as reasoning accepted or the
agreement between reasoning exposed to and reasoning adopted, when this reasoning
diffsers from that used at the pretest. Thus, this measure tests if children are exposed to,
and subsequently adopt, reasoning either higher or lower than that associated with their
pretest rule (Tudge, 1992).

Existing research indicates that when peers who reason at differing levels of
complexity are instructed to reach agreement in solving a problem, they communicate
and discuss justifications that support their contrasting viewpoints. When the reasoning
of one of the partners is transformed to a higher level of complexity while the partners
work to construct shared understanding, intersubjectivity has taken place (Tudge, 1989;
Tudge, 1992; Tudge et al., 1996). Pragmatic, intersubjective agreements-in-meaning lie
at the heart of the cognitive developmental process (Tudge et al., 1996) and the
intervention component of the present study.

Peer interactions, an essential aspect of the intersubjective process, are isolated, often fleeting, social encounters between individuals (e.g., acquaintances, unlike friends with whom peers have enduring relationships) of near-equal chronological ages (Hartup & Laursen, 1999). In general, we know that interactions between peers can facilitate cognitive development because partners provide new information, define problems in such a way that they become cognitively manageable, and generate discussions that culminate in the perceived selection of the best strategies and solutions (Azmitia & Perlmutter, 1989). There are six aspects of peer interactions that serve as contextual factors linking these interactions to the intersubjective process and epistemological development. Each of these aspects is discussed below.

Peer interactions. Interactions among peers, rather than with adults, are most advantageous because of their relatively symmetrical nature (Azmitia & Perlmutter, 1989). Peers are more willing to disagree with each other and reflect on one another’s justifications before accepting them than they are when they engage in problem-solving tasks with adults.

Task-related discussion. Interactions that exhibit task-related discourse (i.e., conversation that is related only to the problem-solving task) are essential to the intersubjective process. Obviously, partners must be intellectually engaged in solving the problem at-hand to understand each other’s perspective, jointly construct meaning, experience intersubjectivity, and develop cognitively (Nelson & Aboud, 1985). Empirically, peers with a higher frequency of theoretically-relevant task-related
discussions demonstrate the greatest developmental gains (Dimant & Bearison, 1991).

Presence of differing viewpoints. Interactions in which there are differing viewpoints are more beneficial than interactions in which partners already share understanding. Cognitive development requires social coordination of differing points of view (Tudge & Winterhoff, 1993). Peers who do not need to work to reach agreement are less likely to undergo the intersubjective process. Hence, they maintain the same level of reasoning while they solve problems together (Tudge, 1989; Tudge, 1992; Tudge et al., 1996).

Optimal balance in cognitive conflict. Intersubjectivity requires cognitive conflict or disagreement. Cognitive conflict is defined as a perceived contradiction between one partner's opinions and the opinions of another (Damon & Killen, 1982). Through cognitive conflict, partners are exposed to other forms of reasoning, adopt some or all of the reasoning while resolving the contradiction, and accept the reasoning as their own when they are satisfied with the meaning the partners have co-constructed (Tudge, 1992; Tudge et al., 1996). Peer interactions that are characterized by an optimal balance in conflict (i.e., interactions that are neither devoid of nor fraught with conflict) are most likely to eventuate in joint construction of meaning (Bearison, Magzamen, & Filardo, 1986).

Openness and willingness to disagree. Interactions in which partners are open and willing to disagree are more likely to advance partners' reasoning than those that are lacking in disagreement. The mere presence of openly discordant discussion enables collaboration and compromise between partners, while it provides interactants an
opportunity to utilize a variety of strategies to articulate their justifications (Damon & Killen, 1982).

*Constructive discourse features.* Intersubjectivity comprises discourse features between partners such as explanation, criticism, and questioning (Nelson & Aboud, 1985). Partners who propose ideas, infer through discussion, defend opinions, dispute arguments, and refer to past experiences (Light & Glachan, 1985) while solving problems together are actively seeking shared understanding.

In the present study, participants will engage in topic-specific, focused group discussions with a group of 14 peers who are expected to be reasoning at differing levels of complexity. Discussions will be directed to encourage open dialogue, an optimal balance of disagreement among participants, articulation of justifications for differing viewpoints, and, ultimately, co-construction of shared understanding of the discussion topic, with the intention of transforming reasoning structures of the participants.

Overall, in the field of child development, reasoning development has been the outcome of interest to those few researchers who studied the *process* of cognitive development. To date, these researchers have centered on a small set of cognitive outcomes or products of children's peer interactions and intersubjectivity during problem solving tasks. The bulk of the research has been done in the areas of rule-based thinking (Tudge, 1989; Tudge, 1992; Tudge et al., 1996), spatial reasoning (Bearison et al., 1986; Doise, Mugny, & Perret-Clermont, 1975), scientific reasoning about distance and speed (Levin & Druyan, 1993), preoperational centration (Light & Glachan, 1985), and distributive justice, or the growth in reasoning about issues of fairness (Damon & Killen,
Studies thus far appear to demonstrate the cognitive developmental benefits of the intersubjective process among children interacting during well-structured problem-solving tasks. The present study will extend past research into late adolescence by investigating the effectiveness of theoretically-based directed group conversations about ill-structured problems, promoting intersubjectivity, and transforming college students' epistemological reflection (Kitchener, 1983).

**Movement into Piagetian Formal Operations**

Until recently, Piaget was the only cognitive developmental theorist who proposed a stage of abstract reasoning that emerges during late adolescence and early adulthood. Furthermore, Piagetian theory suggests developmental process mechanisms similar to those that are involved in intersubjectivity. In this section, Piagetian terms will be used to describe some of the components of intersubjectivity and its application to the transition into formal operational reasoning.

*Disequilibrium, assimilation and accommodation, and equilibration.* Peers cause and facilitate college students' movement into Piaget's formal operational thinking (i.e., thinking that is purely abstract and hypothetical) (Crain, 2000). Piaget described development as occurring through a process of disequilibrium, assimilation and accommodation, and equilibration. Discussion between peers with differing understanding of a topic induces development because it introduces a sense of disequilibrium through cognitive conflict, a discomfort generated by encountering thoughts of another peer that show flaws in one's present thinking. A balance between incorporating the new ideas into the existing cognitive structure (assimilation) and
altering the structure to adjust to the new thoughts (accommodation) leads the person to a
more sound, hierarchically-complex, and sophisticated understanding (Berkowitz &
Gibbs, 1983) or equilibration. Researchers have confirmed that such theoretically higher-
order and effective types of discussion between peers are the single best predictors of
developmental change (Berkowitz & Gibbs, 1983). Although intersubjectivity rather
than these constructs will be measured, it is an underlying assumption that
disequilibration should be experienced and equilibration shall be realized through
participants’ co-construction of shared understanding during their conversations with
peers in the present study’s cognitive development intervention.

The role of the plus-one concept in the process of development. Traditionally, the
plus one concept of cognitive development through the Piagetian stages holds that
teaching from adults should take place just beyond one full stage of the current level of
functioning. Contrary to this theoretical belief, researchers have found that more
sophisticated reasoning is generated through interactions among peers who are
functioning at less than one full stage above a person’s current level of functioning
(Berkowitz, Gibbs, & Broughton, 1980). Such interactions within the stage are more
likely to lead to development because the conflict and disequilibration arise within the
confines of current thinking, while simultaneously activating the potential capacity for
more sophisticated reasoning (Berkowitz & Gibbs, 1983; Berkowitz et al., 1980).
Ideally, the degree of disparity in developmental levels between interacting peers is
closer to within one-third of a current stage rather than a whole stage (Berkowitz &
Gibbs, 1983; Berkowitz et al., 1980). Less and more than one-third of a stage of disparity
between partners have been found to lead to no change at all (Berkowitz et al., 1980). It seems possible that the overlap inherent in a smaller degree of stage disparity between peers is ideal or optimal because the new form of thinking utilizes comprehension that the developing individual currently holds (Berkowitz et al., 1980). One of the important developmental elements of peer-to-peer interactions, which will be realized in this study, is the presence of more competent peers who can expose less competent partners to slightly more sophisticated reasoning (Berkowitz & Gibbs, 1983; Dimant & Bearison, 1991) during problem-solving interactions. The majority of the group discussion intervention members in the present study will be first-year college students functioning at approximately equal or adjacent levels of epistemological reflection, which is consistent with the revised plus-one concept.

**Perspective-taking and formal operations.** The other important developmental element that will be included in the present study is peer reasoning that operates on the reasoning of another (Berkowitz & Gibbs, 1983). As noted, theorists and researchers in the field of child cognitive development have argued that shared meaning promotes development among interacting peers. Perturbations in thought arising from interpersonal sociocognitive conflict and intrapersonal cognitive conflict are natural consequences of engaged discussion with higher-functioning peers and are necessary and critical conditions for disequilibration (Dimant & Bearison, 1991), which ultimately promotes development into formal operations.

Tjosvold and Johnson (1977) assert that exposure to controversies or discussions and disputes about abstract and hypothetical problems in which opposing opinions clash
is critical for the developmental process among adolescents because it leads to enhanced perspective-taking. Formal operational cognitive perspective taking, or knowing another person's cognitive reactions to abstract problems to such an extent that one understands the distinctive way the other person is thinking, enables verifying and defending one's own perspective in relation to the other person's perspective. It is the act of understanding the structure of another person's abstract reasoning that is believed to lead to a more sound and sophisticated understanding of a problem and justifications for its solution, equilibration, and cognitive growth in formal operations (Dimant & Bearison, 1991; Tjosvold & Johnson, 1977). Indeed, empirical investigation verifies that higher frequencies of disagreements, explanations, questions, and agreements (i.e., speech acts that reflect engagement with the partner's reasoning) about abstract problems are associated with greater growth into formal operations (Dimant & Bearison, 1991).

*Extension of intersubjectivity beyond formal operations.* The present study will extend intersubjectivity even further by applying it to the development of epistemological reflection and by providing college students an opportunity to participate in discussions of controversial, ill-structured problems that encourage justifications for viewpoints that take other perspectives into consideration. The next section introduces the Perry scheme (1970), a fine-grained theoretical parsing-out of formal operations into more complex levels of abstract and hypothetical reasoning.

*Perry's Scheme of Intellectual Development*

*The Scheme*

Perry (1970) developed his theoretical scheme of intellectual development
through a series of methods that, he hoped, would satiate his curiosity about the effects of contemporary liberal education on students' intellectual and moral thinking. From 1953 to 1954 he devised the Checklist of Educational Views (CLEV), a measure of students' intellectual and moral thinking preferences, and conducted a study verifying its reliability and validity. Then, in 1955, the CLEV was administered to a random sample of 313 freshmen at Harvard and Radcliffe. Fifty-five of the students who completed the CLEV were invited to participate in interviews. From 1955 to 1958, in late May and early June, Perry collected accounts of the experiences of 31 of these students through purely descriptive, non-systematic, voluntary and completely open-ended interviews (i.e., probes that were intended to pursue topics salient to students in their own academic, social, and extracurricular experiences) (Perry, 1970). Though the students' responses exhibited substantial variability in thinking preferences, Perry and his colleagues detected a common sequence of epistemologies. Next, Perry explored the sequence by implementing another descriptive study of these epistemologies. He randomly selected 50 freshmen from the Class of 1962 and 104 freshmen from the Class of 1963 from the larger sample of one-third of each class that completed a revised CLEV. Of these 154 students, 109 responded, and 67 completed all four interviews. Three hundred sixty-six interview transcripts were used to formulate the Perry scheme, which documents the typical course of development in college students' epistemologies, that is, their evolving patterns of thought surrounding their understanding of the nature of knowledge and identity (Moore, 2002; Perry, 1970, 1981). The pattern of epistemologies emerged as nine coherent structures of thought about knowledge as well as commitments in identity.
(Perry, 1970). The present paper will describe only the five structures that refer to development in thought about the nature of knowledge (i.e., epistemological reflection). The description in this section will center on the conceptual underpinnings of Perry’s theory, which laid the foundation for three decades of extensive empirical verification (1970, 1981). The results of those studies will be delineated later in this chapter.

The Perry scheme portrays an orderly sequence of five systematic, organismic, qualitative changes toward increasing hierarchization, differentiation, and complexity in the development of structured interpretive perspectives. Each perspective, through which students give meaning to their experience and reason about their philosophical assumptions about the nature of knowledge, successively subsumes earlier perspectives (Moore, 2002; Perry, 1970, 1981). All five structures, referred to as positions, are grouped into three broader frameworks of thinking (i.e., dualism, multiplicity, and relativism), extending from absolute right-wrong perception of the nature of knowledge to diversity in understanding the nature of knowledge, derived from consideration of context-based evidence and patterns of comparison (Moore, 2002; Perry, 1970, 1981). It is believed that almost all students encounter the same basic successive reinterpretations, and similar challenges that precipitate these reinterpretations, which, in turn, shape the way they learn (Perry, 1970, 1981). Perry (1970) proposed that once the descriptive scheme has been empirically verified and shown to be reliable, further research should suggest hypotheses about the process through which development is achieved. The present study will be the first to do so. It will apply the concept of intersubjectivity, along with scaffolding (i.e., structured help in using more complex forms of reasoning).
and practice using Perry’s scheme, and test for associations with developmental progress through Perry’s epistemological positions.

Positions and Transitions

Positions (i.e., Perry’s term for stages) are by definition static and development or transition between positions is by definition movement (Perry, 1981). Perry (1970) proposed that development is embodied by transitions and stages are only resting points along the way. As such, the term position, in Perry’s scheme refers to a relatively stable and lasting form of thinking (Perry, 1970, 1981). Within the first five positions of development, students’ views about the nature of knowledge pertain primarily to successive modal modifications of right-wrong dualism in attempting to account for diversity of opinion, experience, and truth (Moore, 2002; Perry, 1970, 1981). The views in these positions are stable and enduring forms or cross-sections of thinking at chosen intervals along the course of cognitive development, that have coherent characteristics of form and function and that vary considerably in their duration. Each position is thought to represent a central tendency (Perry, 1970). In the present study, these central tendencies will be measured to assess the degree to which development is associated with the intervention.

Less stable forms of thinking that mediate between positions characterize transitions (Perry, 1970, 1981). Whatever modal truths there may be in students’ perceptions at a point in time, their transitions may derive in large part from the discrepancies between their assumptions and those held by their peers (Perry, 1970). In Piagetian terms, transitions, incited by disequilibration in the understanding of the nature
of knowledge, are promoted through topic-specific interactions with other people who offer differing viewpoints. Cognitive conflict is resolved through active and open engagement in discourse that facilitates assimilation and accommodation of epistemological structures. Equilibration comes about through this inter- and intra-personal intersubjective process. Perry proposed that this impetus for transition is a dynamic interaction between an organismic press from the individual as a kind of drive or need to conserve the familiar frame of reference and a contextual opportunity or support for progress, emanating from the environment (Perry, 1970). Therefore, transitions can be expressed by an interaction of forces and countervailing forces (i.e., a dialectic between opposing vectors both from within and without, in the social environment) (Perry, 1970). This conception of transitions is the basis upon which the intervention in the present study is built.

The present study consists of several milestones toward reaching the overarching goal to promote critical thinking and students’ academic success: (a) to measure participants’ positions prior to the intervention, (b) to employ the intervention which will capitalize on transitional substructures of epistemology to attempt to propel participants’ development forward, (c) to investigate the degree to which changes in positions are associated with participation in the intervention, and (d) to explore if observed changes in positions after the intervention persist over the course of several months. The next section in this chapter is a review of Perry’s five specific positions and three broad frameworks of epistemological reflection (1970, 1981).

*The First Five Positions*
Position 1. Basic Duality was constructed by Perry as a theoretical starting-point that may begin years before adolescents enter college. The hallmarks of this initial position of epistemological development are (a) an unquestioned view of truth as absolute in stark polar terms, (b) identification with authorities' interpretation of truth, (c) inability to tolerate alternative points of view, and (d) the assumption that hard work and obedience are the basis for evaluation in academic work (Moore, 2002; Perry, 1970, 1981). One single point of view is held by dualists (i.e., the view of an authority or an adult figure with whom they identify such as a parent, teacher, or expert). Truth exists in the absolute and is known by authorities, whose role it is to teach. Students' role is to collect knowledge by hard work and obedience to authorities' rules (Perry, 1970, 1981). This position has rarely been found empirically among high school juniors and seniors. Furthermore, no first-year college students still speak from this position in its purest form by the end of their freshman year (Moore, 2002; Perry, 1970, 1981). It is anticipated that most of the participants in the present study will function beyond this level.

The first challenge, which initiates the transition out of basic duality, often comes from peers, who staunchly assert diversity of opinions in social contexts and in the classroom. Conversations with peers in these settings elicit cognitive conflict and create a sense of disequilibration. Students who undergo this transition, and engage in the intersubjective process with friends and classmates, realize that diversity of opinion cannot exist in an absolute world, therefore, they work to account for it through assimilating other perspectives (Perry, 1970, 1981) and accommodating the old epistemological structure.
Position 2. A vast majority of high school juniors and some high school seniors function in Multiplicity Prelegitimate. At this level, truth is still viewed as absolute. Different perspectives and beliefs are acknowledged with little trouble distinguishing, in polar terms, between right perspectives and wrong perspectives. Increased hierarchization emerges, as dichotomous and dualistic points of view are incorporated, representing two categories of beliefs (Perry, 1970, 1981). Students who function in this second position account for diversity of opinion, uncertainty, and complexity as unwarranted confusion in poorly qualified authorities, contradictions offered by pretenders, or mere exercises set by true authorities so that learners can obediently work their minds to find truth themselves and earn good grades (Perry, 1970, 1981). In essence, two divergent points of view are held, but the different perspectives and beliefs, that are now acknowledged, are deemed simply to be wrong (Moore, 2002). Conversations among the handful of study participants in the present study who are still functioning from Multiplicity Prelegitimate will lend themselves well enough to intersubjectivity because the conversations will enable participants to entertain the possibility of differing viewpoints.

The realization that answers must be searched for leads to the transition out of Multiplicity Prelegitimate and into a new epistemological structure that divides reality into areas where truth seems to be definite and those in which it is vague (Perry, 1970, 1981). The emergence of ideas that initiate intersubjectivity further begets perpetuation of this process of epistemological development. It is expected that those participants in the present study who will engage in discussions with more sophisticated others will
begin to realize that some problems do not have a clear, well-understood solution.

*Position 3.* Multiplicity Legitimate but Subordinate, found widely in first-year and often in sophomore college students, introduces the first acknowledgment and acceptance that uncertainty is a legitimate, yet temporary form of truth. Uncertainty is legitimate until right answers become known. Polar terms still prevail, while previous forms of epistemology are incorporated into a new understanding of the role of uncertainty. Three points of view are held in this third position: right, wrong, and not yet known but to be known at some point in the future (Moore, 2002; Perry, 1970, 1981). Authorities (i.e., respected adults such as teachers, parents, and experts) know what is known. The task of learning is figuring out the process and methodology that should be undertaken to get good grades. Students perceive that there are ostensibly right ways or methods to accumulate enough facts and find the right answers in areas where they are known. If authorities do not yet know all truths in an area, then "we can settle for temporary uncertainty" at least for now. Essentially, diversity of opinion is legitimate but temporary (Moore, 2002; Perry, 1970, 1981). Most of the participants in the present study who will function from this position will be capable of acknowledging and engaging the true essence of the ill-structured problems that will be used in the intervention. They will understand that multiple perspectives can be taken and, perhaps, that none of the perspectives will offer resolution.

Acknowledging the possibility for uncertainty leads to the realization that uncertainty is unavoidable, hence the transition out of this third position. Intersubjective epistemologic group discussions will lead participants to believe that uncertainty and
diversity have spread into authorities' domain of the known, so students will be forced to accept diversity of opinion. However, students who have not fully assimilated and accommodated disparate reasoning structures will become unable to distinguish between legitimate abstract reasoning and counterfeit, poorly justified bull (Perry, 1970, 1981). Contemporaneously, students who accept the challenge of this transition will remain puzzled as to the standards by which academic work is evaluated (Perry, 1970). Rightness and hard work vanish as standards by which to be judged and rewarded by authorities, but substantiation of opinions is not yet perceived as necessary (Perry, 1970, 1981). Comments made by participants during the intervention in the present study may reflect their inability to understand the necessity to justify any perspective to which they subscribe.

Two possible trajectories describe position four and are detailed in the following sections.

Position 4A. Students who become disillusioned in the face of vast uncertainty, resentful of authorities, and oppositional in their epistemological orientation enter the fourth position, typically in their sophomore and junior years in college, by way of Multiplicity (Diversity and Uncertainty) Coordinate (Perry, 1970, 1981). Temporary uncertainty becomes subsumed in a new certainty that "we will never know anything for sure." Truth is viewed as uncertain. Thus, what is most important, while functioning with this view of the world, is one's own thinking (Moore, 2002). Although this position allows the more hierarchically-complex admission that an infinity of points of view exist, it communicates the idea that "all which authorities cannot prove to be wrong, is right" —
a fundamentally polar understanding of the nature of knowledge (Perry, 1970, 1981). In other words, the structure of Multiplicity Coordinate preserves the dualistic nature of earlier structures by creating a double-dualism of a world in which authorities' right-wrong perspective is one element and students' personalistic diversity of opinion is the other. The world would seem chaotic to these students unless this distinction is made (Perry, 1970, 1981). The attitude that “where authorities do not know the answer, any opinion is as good as any other” grants oppositional students security in complete freedom of opinion (Perry, 1970, 1981) and liberty at taking an oppositional stance towards authority's perspective. Remarkably, these same students hold an egalitarian respect for others through a respect for their views. According to these students, persons are their opinions and opinions are unrelated to evidence, reason, experience, expert judgment, context, principle, or purpose (Perry, 1970, 1981). Students who view the world from this position believe that quantity of facts, work, and opinions (albeit unsupported) are the basis for good grades (Perry, 1970, 1981). The awareness of a capacity for comparing the assumptions and processes of qualitatively different ways of thinking, including one’s own thinking, has not yet emerged (Perry, 1970, 1981). The few oppositional participants in the present study may facilitate the intersubjective process for all other participants due to their egalitarian respect for and openness to other viewpoints.

Oppositional students have special difficulty embarking on the transition out of Multiplicity Coordinate because they embrace this position with such great enthusiasm. Their eventual transition is either incited by requests from peers who demand that they
substantiate their opinions or it is elicited by the acknowledgement that if *some facts* are necessary (i.e., a quantitative criterion), then *better* opinions may be possible (i.e., a qualitative notion) (Perry, 1970, 1981). Participants in the present study who move out of their oppositional stance may begin to embrace the advantageous consequences of intersubjectivity (i.e., arriving at a agreed-upon shared understanding) by heeding others’ pleas for justifications or by relinquishing blind egalitarianism.

*Position 4B.* Students who are more trusting of authorities and adhering more closely to their viewpoints in their epistemological orientation than Multiplicity Coordinate residents, enter the smoother pathway through Relativism Subordinate, typically in their sophomore and junior years in college (Perry, 1970, 1981). Their view of knowledge is “do your own thing,” and the attitude “anything goes” prevails in this position (Moore, 2002; Perry, 1970, 1981). Truth remains completely uncertain. The terms for understanding truth are no longer polar. Instead, the distinction that propels adhering students gracefully through Relativism Subordinate into the final position is an increase in self-processing of beliefs and ownership of ideas (Moore, 2002; Perry, 1970, 1981). Earlier, authorities were holders of meaning. From this point onwards, everyone can be a maker of meaning (Perry, 1970, 1981), therefore infinite points of view are possible. Awareness of metacognition emerges through a capacity to contrast interpretations and thought systems and compare different approaches to a problem in developing one’s own opinion (Perry, 1970, 1981), which, according to these students, will result in good grades. Though these students do not yet endorse the necessity of using evidence in making judgments, they understand that the basis for determining the
quality of beliefs in academic work is not arbitrary (Perry, 1970, 1981). Even in areas of uncertainty, trusting students set out to pinpoint authorities' grounds for grading, as they believe that they need to think the way authorities want them to think, which leads to the discovery that complex justifications need to be articulated and relationships should be weighed (Perry, 1970, 1981). Participants in the present study who take this position may enjoy the intersubjective discussions about ill-structured problems more than the others described thus far because they will be asked to self-process their own constructed and co-constructed shared meaning and epistemological solutions surrounding complex dilemmas. These few participants may be the most effective in engaging the intersubjective nature of intervention discussions.

In Relativism Subordinate, delivering “what authorities want” – a very early form and simple case of a complex context of assumptions, rules, and contingencies – assumes no personal responsibility (Perry, 1970, 1981). The transition through this latter form of Relativism Subordinate reflects a turning point from an assimilation of incongruities into a fundamentally dualistic frame of reference to an active accommodation of the fundamental assumptions of one’s frame of reference that more fully accounts for complex, contextual, relativistic conceptions of ideas. Accommodation of the epistemological structure appears to be brought about by the sheer weight of the quantitative expansion of incongruities. Uncertainties or diversities in opinion multiply until they tip the balance forcing the construction of a new vision of the world (Perry, 1970, 1981). Taking ownership helps students begin to perceive qualitative contextual relativistic reasoning as a special case of “what authorities want” (Perry, 1970). Though
few participants in the present study will be negotiating this transition, those who will
may be the most willing to incorporate others’ perspectives into their own during the
intervention.

Position 5. The shift from the latter parts of positions 4a and 4b into position 5 is
most noteworthy because there is no longer an elaboration on dualistic thinking. Rather,
these epistemological structures afford greater acknowledgement of uncertainty in and
evidence-based justification of perspectives (King & Kitchener, 2002). The rare
transition to Contextual Relativism, toward the end of the college years and shortly
thereafter, represents a fundamental transformation of one’s perspective: from a vision of
the world as essentially dualistic, with a growing number of exceptions to the rule in
specific situations; to the most hierarchically complex vision of the world as essentially
relativistic and context-bound, with few right-wrong exceptions (Moore, 2002; Perry,
1970). The most significant distinction between positions 4 (a and b) and 5 is the
noticable difference in the degree to which students are self-conscious and apply a sense

In this final position, truth is conceptualized as a vast set of irreducible
uncertainties. Since polar terms no longer suffice, truth becomes relative and context-
bound. Contextual Relativists have internalized the responsibility and initiative that used
to be the domain of authorities. Points of view are seen as relative. Each task in
academic work, as well as life, is understood as a pursuit of judgments and meaning-
making in all realms through the use of evidence and reasoned consideration of relevant
matters. Thinking becomes acting (Moore, 2002; Perry, 1970, 1981). To think well and
receive good grades requires exploring alternative perspectives, using evidence in forming judgments, and taking a stance in many areas (Moore, 2002; Perry, 1970, 1981). A concern for precision of thought within given contexts requires disciplined metacognition and an appreciation for irreducible uncertainty in most arenas (Perry, 1970, 1981). It is expected that almost none of the participants in the present study will function from this position. Those who do may not be understood by the others, as they will be functioning far more than one-third (or even one full) stage beyond the majority of participants. In essence, these students’ meaning will probably not be shared by others. That is, the intersubjective process is not proposed to take place between less sophisticated participants and these students.

Perry’s Three Broad Frameworks

As noted, all of Perry’s epistemological positions are grouped into broader frameworks of thinking. The five specific positions described above are combined to form three overarching increasingly sophisticated descriptive frameworks of epistemological development.

Dualism. Dualism (composed of positions 1 and 2, Basic Duality and Multiplicity Prelegitimate, respectively; characteristic of a handful of participants in the present study) is characterized by the division of meaning into two realms – right versus wrong, good versus bad, we versus they. Right answers are known by authorities, thought to exist somewhere for every problem, and are to be memorized by hard work. Knowledge in this framework is viewed as a quantitative accumulation of facts (Perry, 1981). A small percentage of the sample in the present study is expected to function within this
framing the scheme.

Multiplicity. Multiplicity (composed of positions 3, 4a, and 4b, Multiplicity Legitimate but Subordinate, Multiplicity with Diversity and Uncertainty Coordinate, and Relativism Subordinate, respectively; characteristic of a majority of participants in the present study) brings a confrontation and coping with diversity and multiples in virtually everything (Moore, 2002). Diversity of opinion and values, in this framework, is recognized as legitimate in areas where right answers are not yet known, hence "everyone has a right to his own opinion" and none can be considered wrong (Perry, 1981). Essentially, the majority of the sample in the present study are expected to manifest this framework of thinking.

Contextual relativism. Contextual Relativism is composed of position 5 (characteristic of a rare few participants in the present study). This framework entertains diversity of opinion, values, and judgment derived from evidence, logic, coherent sources, systems, and patterns which allow for analysis and comparison. This reasoning structure accepts that there will always remain matters about which reasonable people will reasonably disagree, while it acknowledges that some opinions may be found worthless. Knowledge is viewed as qualitative and dependent on contexts (Perry, 1981). This framework and its corresponding stage represent the teleological hallmark of the theory, rarely found among first-year college students.

Developmental Concerns

Discontinuity in movement. The positions within the scheme represent intraindividual qualitative shifts in forms of epistemological reflection. The laws by
which positions are formed vary at different times in the ontogeny of a person (Lerner, 1986). Perry and his colleagues (1970) found that growth was rarely linear and more usually wavelike, occurring in surges. Between the surges, a person might pause to explore the implications of the new position or lie fallow waiting for the resurgence of strength to meet the next challenge (Perry, 1970). Frequent surge-like patterns have been found empirically among first-year students (Kitchener et al., 1993), therefore, it is expected that many of the participants in the present study will experience a qualitative shift in epistemological thinking.

*Patterns of deflection or backwards movement.* According to Perry (1970), deflection is multi-directional movement that strays away from a teleological trajectory toward increased complexity and hierarchization. It could emerge in the form of pause or backwards movement. Prolongation or pause, alienation or escape, and regression or retreat from a position in the progression toward contextualism, are typical forms of deflection from development, according to Perry (1970, 1981). Temporizing is postponement, prolongation, or delay of movement in any position for a year or more. It entails waiting until some event sheds light on the next structure of thinking (Perry, 1970, 1981). This pause in movement usually lasts a full academic year. It is expected that the diversity of thought, richness of novel experiences, and vastness of new ideas afforded by the first year of college will reduce the likelihood that this pattern of deflection will occur much among participants in the present study. In any case, temporizing ends either in a resumption of growth or a drift into escape.

Escape is a strategy of alienation, abandonment of responsibility, and exploitation
of multiplicity or relativism to avoid commitment or the despair and guilt associated with confusion or sensed intellectual incompetence. Perhaps some of the students in the present study will travel along the oppositional pathway and may escape position 5 reasoning to avoid the complexities of it, manipulating the opportunity for detachment to deny responsibility, drifting and foregoing opportunities to commit to or identify with a particular perspective (Perry, 1970, 1981). Some students who negotiate the uncertainties of position 4 through adherence retreat to dualism to avoid ambivalence. The few students in the present study who travel along this trusting pathway may entrench themselves in the previously-prepared dualistic, all-or-none, absolutistic structures of positions 2 or 3, holding extreme opinions to assert an absolutism that “wishy-washy authorities” have abandoned (Perry, 1970, 1981).

Decalage or lateral movement. Lateral movement, according to Perry (1970) is a spreading out and consolidation of a position recently attained and mastered in a particular domain or set of domains. Although the whole Perry scheme is an arrangement of the structures into a sequence of positions along a single dimension of development, with each position simultaneously including and transcending previous ones, no assumption should be made about the domain-specificity or restriction of range of positions which can be present at any given time (Perry, 1970, 1981). Rather, multiple adjacent forms may co-exist in some students as they progress in order through positions toward disciplined contextual relativistic thought (the theoretical teleological endpoint) (Perry, 1981). Though students' remarks about various topics may manifest a range of structures (i.e., decalage), the overarching position represents the modal structure or the
locus of central tendency among the structures (Perry, 1970). Students in the present study may move, in various areas, from a familiar pattern of meaning that is insufficient toward a new vision that simultaneously promises to make sense and threatens to challenge thoughts with unanticipated implications (Perry, 1981). These students' reports on the outcome measure of five different domains of thinking may demonstrate the co-existence of two or more substructures in addition to one predominate, preferred position.

Recursive nature of development or recapitulation in movement. Growth and discoveries throughout this scheme are recursive – the same issues are faced repeatedly, from different and broader perspectives each time (Perry, 1970, 1981). The early levels of concrete interpretation are recapitulated in later levels of more abstract understanding, repeating at each new level a sequence of development analogous to those that were completed earlier. For epistemological reflection, recapitulated development of philosophical assumptions, recurring on each level, consists of a movement from an egocentric, undifferentiated position to one of more objective and differentiated relations with the world (Perry, 1970). It is possible that recapitulation among participants in the present study might be difficult to find, due to the relatively short duration of the study in the context of these students' whole developmental trajectories through the Perry scheme.

Perry's descriptive theoretical scheme has withstood examination by Perry and his colleagues in three separate random samples, undergone subsequent tests of validity (Perry, 1970, 1981), and witnessed repeated verification in innumerable samples over the past three decades (e.g., Baxter-Magolda, 1987, 2001; Baxter-Magolda & Porterfield, 1985; King & Kitchener, 1994, 2002; King, Kitchener, Davison, Parker, & Wood, 1983;
Kitchener & King, 1981; Kitchener, King, Wood, & Davison, 1989; Schmidt, 1985; Welfel & Davison, 1986). It should be noted that Perry did not engage in this rigorous empirical work himself. Perry’s work was mainly descriptive, leaving a relatively unverified scheme that established the sequence of positions based on labor-intensive, loosely qualitative data drawn from a very biased, advantaged sample in extensive face-to-face interviews. More recent work by Kitchener and King (which will be described at length in the next section) provides the majority of the empirical confirmation for the scheme’s positions and implicitly suggests the process or transitions of development. The work of Baxter-Magolda (Baxter-Magolda, 1987; Baxter-Magolda & Porterfield, 1985) represents a new direction in efficiently assessing the positions in which students function. The present study will be the first to include a revised version of Baxter-Magolda’s measure while embarking on an explanatory test of the process of development through Perry’s positions. That is, it heeds Perry’s call to focus on the transitions instead of the positions.

**Kitchener and King’s Reflective Judgment Model**

As noted above, the Perry scheme has withstood repeated verification in many samples over the past three decades by a group of researchers interested in college students’ intellectual development. The bulk of this research was done by Kitchener, King, and colleagues (Davison, King, & Kitchener, 1990; King & Kitchener, 1994, 2002; King et al., 1983; Kitchener & Fischer, 1990; Kitchener & King, 1981; Kitchener et al., 1989; Schmidt, 1985). The following section of this chapter will describe the unique theoretical constructs of Kitchener and King’s closely-related reflective judgment model.
It will then describe the process by which college students may progress through their seven stages of reflective judgment toward increasingly complex levels of organization. Then, the feature that distinguishes Kitchener and King's work from Perry's—a detailed explication of empirically-based developmental patterns of reflective judgment among college students—will be described. This section of the chapter will close with a description of three theoretically-based methodological elements that Kitchener and King developed and that the intervention in the present study employs (i.e., ill-structured problems, the Reflective Judgment Interview, and the Prototypic Reflective Judgment Interview and patterns of change associated with it).

Referring to Perry's scheme as an initial theoretical framework, Kitchener and King (1981) analyzed the various forms evident in Perry's levels of epistemological reflection. Their early analysis of the scheme and scoring procedures provide an invaluable empirical contribution to the understanding of the development of contextual relativistic thought (Perry, 1981). Since then, a tradition of work surrounding a model of seven distinct stages of epistemological reflection emerged (King & Kitchener, 2002; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989). The model illustrates a developmental progression of increasingly complex structures, similar to Perry’s, in people’s assumptions about reality and knowledge, as well as the relationship between these assumptions and appropriate justifications for them (Davison et al., 1990; King, 1996; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989; Schmidt, 1985; Welfel & Davison, 1986).

According to Kitchener and King's reflective judgment model, as in Perry's
theory, the means by which people form judgments and justify their points of view becomes increasingly more sophisticated and comprehensive, and typically extends from unexamined reliance on the word of an authority figure (i.e., a respected adult, teacher, parent, or other expert) to a thoughtful examination and evaluation of available evidence and a determination of a reasoned judgment based on that evidence (King & Kitchener, 2002; Kitchener & King, 1981; Schmidt, 1985). The main theoretical difference between Perry’s (1970, 1981) epistemological reflection positions and Kitchener and King’s reflective judgment stages lies in Kitchener and King’s emphasis on three specific conceptual elements: (a) assumptions about reality, (b) assumptions about knowledge, and (c) concepts of justification (Kitchener & King, 1981). Further, whereas Perry’s theory mixes strands of intellectual and ethical development, the reflective judgment model concerns only intellectual development. Finally, the reflective judgment model identifies aspects of assumptions and justifications for dualistic and relativistic thinking that serve as precursors to the development of the most sophisticated form of reasoning, reflective thinking (Davison et al., 1990; Kitchener & King, 1981). Since Kitchener and King’s model implicitly suggests the empirically unexamined process of development out of each of the reflective judgment stages (the central emphasis and purpose of the present study), the next portion of this chapter will focus on the description of those proposed transitions out of the stages, with special attention granted to the original authors’ ideas surrounding assumptions about reality, assumptions about knowledge, and concepts of justification.

The Process of Transition Out of Each of the Reflective Judgment Stages
The early work of Kitchener and King (1981) offered an implicit description of the catalysts that prompt the process by which students progress through each of the seven stages of reflective judgment. Discrepancies between one’s own assumptions and justifications and those of others provide the impetus for generating better and more complete explanations of reality (Kitchener & King, 1981). Such catalysts, created by the realization of inadequacies in simple ways of thinking, serve as the stimulus for change (King et al., 1983). Generally, the first major shift allows individuals to understand knowledge in relationship to the context in which it is embedded, while successive shifts allow individuals to understand assumptions about knowledge as encompassing apparently contradictory perspectives. These shifts also enable the progression toward more informed justifications supported by the integration or synthesis of evidence (King et al., 1983).

Transition from stage 1. In Stage 1, to observe is to know. It is expected that few participants in the present study will still believe that only objective reality exists. These few students may still fail to perceive alternative assumptions, and may not understand that justifications for assumptions are necessary (Davison et al., 1990; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981). Although there is a failure to differentiate one’s own assumptions from an authority’s, encountering disagreement among multiple authorities forces students to deny the discrepancies or reevaluate their own assumptions about reality and knowledge. An active search for answers from ‘other’ authorities forces movement beyond the absolute, simple egocentrism of Stage 1 (King, 1996; Kitchener & King, 1981). The transition out of this stage reflects development
from an assumption of singular pre-existing knowledge to an awareness of two categories of knowledge (i.e., right and wrong) (Kitchener & King, 1981).

Transition from stage 2. During Stage 2, some assumptions are deemed to be right and some assumptions are deemed to be wrong. The task, for the participants in the present study who will function at this level, is to find the right answers. At first, assumptions are unexamined and unjustified or they are still justified by correspondence with an authority’s perspective (Davison et al., 1990; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981). In the process of searching for authorities with whom to identify, Stage 2 students stumble onto the realization that there may be more than one ‘right’ assumption, and that legitimate authorities may disagree. It also becomes apparent to these students that one’s own assumptions may have to be justified. The new need for justification leads to the abandonment of an old assumption that certain knowledge is always possible to attain (King, 1996; Kitchener & King, 1981).

Transition from stage 3. At Stage 3, there are some right assumptions, some wrong assumptions, and some that are temporarily uncertain. During this stage, which it is expected will be evinced by most of the participants in the present study, justification of assumptions in ‘certain’ areas is still done by reference to an authority’s perspective (Davison et al., 1990; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981). In areas of temporary uncertainty, only personal assumptions are believed until absolute knowledge is obtained. However, holding the personal assumption that “mine is only one way to perceive the truth” leaves individuals vulnerable when they are asked by others to justify their assumptions. The dissonance that is created by holding unjustified
assumptions forces students to seek more defensible principles on which to base their assumptions (King, 1996; Kitchener & King, 1981). The transition out of this stage comes through an unsuccessful search for one defensible answer to justify assumptions or through an unsatisfying wait for the 'right' answer to emerge (Kitchener & King, 1981). The shift into stage four is most noteworthy because it marks the first true acknowledgement of uncertainty (Davison et al., 1990).

Transition from stage 4. Students who function in Stage 4 are faced with the apparent reasonableness of many assumptions, which are idiosyncratic to each individual and not externally validated. For those few participants in the present study who are expected to manifest this stage of thinking, the acknowledgement that uncertainty is a necessary aspect of knowing, harkens the emergence of the view that evidence is part of forming and justifying assumptions (Davison et al., 1990; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981). Students begin to understand that there is a relationship between knowledge and the rules of inquiry one uses to discern knowledge and that one's own and others' assumptions should be justified in terms of evidence usage and other criteria of evaluation (King, 1996; Kitchener & King, 1981). As students debate with each other about differences in assumptions and learn rules of evidence usage for particular domains, they are eventually faced with a less individualistic understanding of assumptions about truth and reality (Kitchener & King, 1981).

Transition from stage 5. In Stage 5, multiple subjective assumptions exist. There are as many assumptions about reality as there are people perceiving it, but those assumptions are justified through the use of evidence within particular perspectives or
contexts (Davison et al., 1990; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981). It is expected that few participants in the present study will subscribe to these assumptions. Notwithstanding, as students move through the end of Stage 5, it is in the act of comparing contextual and subjective assumptions to each other, as well as to one's personal experience, that new internal categories begin to emerge and form the basis for the next stage of understanding — the comprehension of 'better' assumptions about reality and knowledge (King, 1996; Kitchener & King, 1981).

**Transition from stage 6.** It is expected that none of the participants in the present study will function at either Stage 6 or Stage 7 levels of thinking. Notwithstanding, during Stage 6, students are aware that the knower must play an active, more responsible role in making meaning by comparing evidence and opinions across a variety of perspectives, thus constructing 'better' assumptions that continue to be based on evaluative criteria (Davison et al., 1990; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981). Problematic domains require even more active thinking on the part of the individual. However, tentative judgments about and choices between several valid interpretations by respected others are inevitable. These judgments eventually initiate thoughts that will generalize to an ability to synthesize multiple elements into a coherent point of view (King, 1996; Kitchener & King, 1981).

**Stage 7.** Finally, for some upperclass college students and college graduates, true reflective judgment arises at Stage 7 (Kitchener & King, 1981). These individuals acknowledge that assumptions about knowledge are the outcome of a process of reasonable inquiry. Objective understanding of reality is that which is *most* reasonable or
probable. Evidence and interpretations are synthesized to justify assumptions about the best solution for complex problems. One's ideas are subject to the criticism of others. Similarly, individuals are able to evaluate their own beliefs as rational conjectures about reality (Davison et al., 1990; King & Kitchener, 1994; King et al., 1983; Kitchener & King, 1981). Conclusions are reevaluated regularly when new evidence becomes available. This advanced reformulation of assumptions includes comparison to internalized categories of justification (King, 1996; Kitchener & King, 1981).

Kitchener and King's implicit description of the progression out of these reflective judgment stages suggests the existence of intersubjectivity. Peers' and authorities' opinions, questions, and requests for justification compel students to search for new meaning, which can frequently be found in the perspectives of others. The present study will combine Perry's call for and the reflective judgment model's invitation to investigate this process by including intersubjectivity in both the design of the study and the measure of the process that transpires during the cognitive intervention.

**Ill-Structured Problems vs. Well-Structured Problems**

The present study will also follow the explicit methodological advice of Kitchener and King and include in the intervention ill-structured problems or complex dilemmas rather than solvable well-structured problems. Ill-structured problems are far more commonly encountered by older adolescents and young adults; whereas, well-structured problems are not as relevant to the intellectual development of people in these age groups as they are to children. This recommendation marks a direct break from the traditional Piagetian paradigm, which mainly employs well-structured problems because they are
appropriate and sufficiently difficult for children.

Well-structured problems are puzzles that are solvable and have a definitive, knowable solution and path to that solution (Kitchener & King, 1981; Wood, Kitchener, & Jensen, 2002). These problem types have been labeled puzzles because all the information needed to successfully solve them is given in their presentation. The correctness or incorrectness of an answer is known, with certainty, by any knowledgeable problem solver (Davison et al., 1990; King & Kitchener, 1994, 2002; Wood et al., 2002). Such reasoning is required in deductive and inferential problem solving, most often the object of psychological and educational research with children (Wood et al., 2002). However, they are of limited relevance to problem-solving required in the daily decision making of late adolescents and adults, whose critical thinking involves making and defending complex judgments (Davison et al., 1990; King & Kitchener, 1994, 2002; Kitchener & Fischer, 1990). King has documented a decline in strictly Piagetian formal operations from high school through graduate school, remarking that such logic, so necessary to solutions of 'puzzles', is inadequate for addressing real world 'problems' in life (Kitchener & King, 1981; Wood et al., 2002). As thinking evolves, individuals develop the ability to differentiate between puzzles and complex dilemmas. They recognize that while the answers to puzzles can be known with certainty, ill-structured problems require the construction of knowledge through a process of inquiry or through integrating and synthesizing different perspectives into a solution (Davison et al., 1990).

Ill-structured problems, which will be used in the intervention of the present study, are those for which some of the parameters of the problem are unavailable or
unknown and for which no effective procedures (e.g., deductive or inductive) can guarantee a correct solution. An ill-structured problem results when the most relevant facts, path to solution, potential outcomes, or utility of potential outcomes are unknown or not known with a high degree of certainty. For these problem types, no clear solution exists and there is often ongoing controversy about solutions, even among qualified experts. Therefore, solutions must be made in the face of uncertainty and disagreement (Davison et al., 1990; King & Kitchener, 1994; Kitchener & King, 1981; Wood et al., 2002). In sum, no specific procedure is sufficient to come to a conclusion in ill-structured problem solving. Rather, several routes to vastly different conclusions are possible (Kitchener & King, 1981; Wood et al., 2002).

According to the reflective judgment theory (Kitchener & King, 1981), to identify and solve the ill-structured problems in the present study, individuals will need to actively organize and structure incomplete and sometimes conflicting information in order to arrive at a solution. Through the intervention discussions which ask participants to consider controversial issues, assumptions may be invoked by participants to monitor the epistemic nature of the problems and the extent to which a solution could be considered to be true or right (Davison et al., 1990; King & Kitchener, 1994; Kitchener & King, 1981; Kitchener et al., 1989; Wood et al., 2002). Differences in participants' conclusions about controversial issues may be related to their prior assumptions and the criteria they use to evaluate arguments and possible solutions (Kitchener & King, 1981). In the present study, it is anticipated that the handful of participants with Stage 2 thinking may not really recognize the ill-structured nature of the problems that are presented,
while most participants that evince Stage 3 thinking may deny the ill-structured nature of the problems because truth may seem to them to be temporarily inaccessible. The few Stage 4 participants may give ill-structured problems legitimacy by granting that truth is unknowable. These participants' thinking may not include an understanding of how to validate their interpretations. Though it is expected that almost none of the participants should exhibit Stage 5 thinking, those who will could allow evidence-based validation for ill-structured problem solutions, but still provide little or no basis for comparing perspectives (Davison et al., 1990).

The Reflective Judgment Interview

Another methodological component of the present study which will be borrowed from the work of Kitchener and King is the Reflective Judgment Interview. The Reflective Judgment Interview (RJI) is the method by which Kitchener and King collected the data for their extensive empirical studies (Davison et al., 1990; King & Kitchener, 1994, 2002; King et al., 1983; Kitchener et al., 1989; Kitchener & Kitchener, 1981; Schmidt, 1985; Welfel & Davison, 1986; Wood et al., 2002). It should be noted that scoring of the RJI will not be employed in the present study, since a paper-and-pencil quantitative measure of Perry’s positions was chosen over the rather expensive and labor-intensive qualitative assessment of reflective judgment stages that the RJI provides.

The RJI was developed to elicit ratable data regarding individuals' fundamental assumptions about knowledge and how it is gained (King & Kitchener, 1994). The interview is mainly concerned with how people reason when faced with the task of making judgments about ill-structured problems, herein referred to as dilemmas (Davison
et al., 1990; Kitchener & King, 1981; Wood et al., 2002). This semi-structured interview entails reading a dilemma aloud and asking participants a series of probe questions about their beliefs regarding the dilemma.

Four intellectual dilemmas and seven standardized probe questions were chosen by Kitchener and King (1981) to elicit subjects’ epistemological reflection. The dilemmas represent different intellectual domains: evolution versus creation of the human race, the construction of the pyramids (to be used in the present study), the effect of chemical additives on foods (to be used in the present study), and the nature of news reporting. The dilemmas represent religion, history, science, and current events, respectively (Kitchener & Kitchener, 1981; Wood et al., 2002). The breadth of these topics is intended to assure some generality, cover a range of domains, and pertain to issues about which the general public has some information. Dilemmas are typically presented in a random or counterbalanced order to control for the effects of order and fatigue (King & Kitchener, 1994). Each dilemma is defined by two conflicting and contradictory points of view and explicitly refers to the fact that disagreement, ongoing controversy, and opposing viewpoints, even among qualified experts, exists about the solution to the issue (Davison et al., 1990; King & Kitchener, 1994; King & Kitchener, 2002; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989; Schmidt, 1985; Wood et al., 2002). The probe questions (to be adapted for use in the present study) are designed to elicit subjects’ statements and justifications regarding their views about the dilemma, nature and certainty of knowledge, nature of evidence and reasoning to support views, role of authorities in resolving the controversy, and their openness to alternative
views or frames of reference (Welfel & Davison, 1986; Wood et al., 2002). Reflective judgment interviews last up to four hours per testing session. Scoring is designed to reflect whatever stage-characteristic assumptions are evident in the transcripts (King & Kitchener, 1994).

To date, more than 1,700 individuals representing demographically homogeneous student and non-student subgroups have been tested with the RJI in longitudinal studies spanning as long as ten years, cross-sectional studies covering various multi-year periods, and sequential cross-sectional studies ranging from two- to four-year intervals. Over 150 of the participants in these studies were high school students, 1,100 were traditional or nontraditional college students, and about 200 were graduate students. In addition, more than 150 non-student adults have been tested (King & Kitchener, 1994).

One ten-year longitudinal study captured the longest span of years and the most testing of any group of individuals. This study began in 1977 with a cross-sectional investigation of 3 cohorts of students (20 high school juniors, 40 college juniors, and 20 third-year doctoral students) ranging between 16 and 28 years of age at the first testing. The study continued in longitudinal format in 1979 and 1983, and ended in 1987 (King & Kitchener, 1994). The high school and college students in the sample were matched to the graduate students by gender and academic aptitude to prevent the possibility that group differences might be a function of differences in either of these variables. Useable data were obtained for 53 individuals or 66% of the original sample. Most of these participants were engaged in some aspect of formal education (King & Kitchener, 1994). It should be noted that no information is given by the authors, at any time, which suggests
that this sample included under-represented or under-advantaged students.

Six other longitudinal studies, involving two testing periods, at intervals ranging from three or four months to four years, included varying numbers of homogeneous high school students, traditional and non-traditional first-year college students, college students more generally, and advanced doctoral students. The cross-sectional studies that have been conducted include almost 1,500 students from diverse geographical regions of the United States, ranging in age from adolescence to middle adulthood (King & Kitchener, 1994). In general, there is a dearth of research on under-represented populations of students. One study of African-American college students, one study of Hispanic college seniors, two studies of semirural college students in southern Colorado, and one cross-cultural study of traditional German university students provide preliminary support for the cross-cultural applicability of the RJI, but the authors encourage more research in diverse samples (King & Kitchener, 1994, 2002). The following section delineates the broad and specific patterns of results that have emerged through this body of empirical work and lays the foundation upon which some of the methods and hypotheses of the present study are based.

*Empirically-Based Patterns of Epistemological Development*

*Sequentiality of stages.* Extensive research by Kitchener and King verifies the theoretical description of seven predictable shifts in epistemic assumptions that develop in a stage-like way, with higher stages developing out of lower stages in a sequential fashion (King & Kitchener, 1994, 2002; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989; Schmidt, 1985; Welfel & Davison, 1986; Wood et al., 2002).
Empirical evidence demonstrates that the seven stages of increasingly complex and
internalized assumptions and methods of justification (Davison et al., 1990; King &
Kitchener, 1994, 2002; King et al., 1983; Kitchener & King, 1981) are hierarchically
ordered, with each succeeding stage building on the accomplishments of the previous
stage and representing a more complex and effective form of epistemological
justification. Each stage represents a reorganization of underlying cognitive structures,
and therefore, a qualitatively different frame of reference for understanding the knowing
process and the nature of inquiry (Davison et al., 1990; King et al., 1983; Kitchener &
King, 1981; Kitchener et al., 1989; Schmidt, 1985). Thus, as development progresses,
steps in the sequence have not been found to be skipped. In empirical tests, the
sequentiality hypothesis, which preserves the concept of ordered stages but does not
assume that people reason at the same stage in all situations due to differential task
demands, has been supported (Kitchener et al., 1989). Individuals use adjacent rather
than non-adjacent stages in their reasoning. Patterns of results indicate that the second
most frequently used stage (i.e., the sub-dominant stage) is adjacent to the most
frequently used stage (i.e., the modal stage), and the third most frequently used stage is
adjacent to either the modal stage or the sub-dominant stage. In other words,
developmental changes are evidenced by a sequentially shifting distribution of scores
spanning three or fewer stages, rather than by movement into and out of a single stage at
one time (King & Kitchener, 1994, 2002; King et al., 1983; Kitchener & King, 1981;
Kitchener et al., 1989). Participants in the present study are anticipated to exhibit one or
two stages of thinking and move in the direction of only adjacent forms of
epistemological reflection.

**Consistency of stages across dilemmas.** The reflective judgment model does not assume that development is characterized by absolute synchrony in stage scores across domains of thought (Davison et al., 1990; King et al., 1983). Instead, stages represent a reasonable modal estimate of the epistemic assumptions with which individuals approach and understand a variety of domains of problems (Davison et al., 1990; King & Kitchener, 1994, 2002; Kitchener et al., 1989). Kitchener and King’s research reveals that students appear to evidence moderate to highly consistent stage scores both within and across dilemmas (Kitchener & King, 1981). In addition, there is significant consistency in stages across superficially dissimilar dilemmas as well as across dilemmas that are drawn from considerably different domains (Davison et al., 1990; King & Kitchener, 1994, 2002; Kitchener et al., 1989). In several tests of consistency in stages across dilemmas, modal scores were moderately consistent 75% of the time across various dilemmas given at any single testing (Davison et al., 1990; King & Kitchener, 1994, 2002; Kitchener et al., 1989). Participants’ responses to items in the outcome measure in the present study will be scored according to their modal and sub-dominant forms of epistemological reflection.

**Associations with maturation and education.** According to the reflective judgment model, how intellectual problems are understood, problem solving is undertaken, and corresponding principles of evaluation and rational justification are used are believed to change over both age and educational levels. The research of Kitchener, King, and colleagues (King & Kitchener, 1994; King et al., 1983; Kitchener & Kitchener,
1981; Schmidt, 1985; Welfel & Davison, 1986; Wood et al., 2002) suggests that such development probably occurs through a complex interaction of both maturational and environmental factors. Their data suggest a consistent orderly relationship between stage scores and age groups, with older subjects scoring at higher stages than younger ones, and stages significantly increasing over a two-year period of time. Specifically, the overall correlation across studies between stage score and age was .79 (King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989). There is evidence for developmental discontinuities or spurts between the ages of 18 to 20 (Kitchener et al., 1993). The frequency of usage of Stages 2 and 3 decreases after age 20.5, while Stage 4 increases through ages 20.5 to 24.5 and then decreases, and Stage 5 usage increases from 5% before age 20.5 to 50% after age 28.5 (Kitchener et al., 1989). However, in most of their studies, age is confounded by education. There is greater growth in epistemic cognition for those who attend and complete college than for those who do not (King & Kitchener, 1994, 2002; Kitchener et al., 1989). The present study is designed to reveal developmental discontinuities. In addition, it will control for the effects of both age and education by focusing on a sample that is exclusively comprised of traditional-aged first-year college students.

 Patterns from high school into college. In general, high school juniors appear to function in the second stage of reflective judgment and seniors appear to begin to function in the third stage. A six-year study of 16 to 20 years olds (i.e., high school juniors to college juniors) found that the most dramatic growth involved a two-stage increase (Kitchener et al., 1989). The mean reflective judgment stage score for high
school juniors in one study was 2.77, with 90% scoring between Stage 2 and Stage 3 (Kitchener & King, 1981). In the first two-year study of reflective judgment, the mean reflective judgment stage score for high school juniors and seniors ranged from 2.28 to 4.07. When these students were juniors their mean stage score was 2.79; when they were first-year college students the mean stage score was 3.61. All students in this sample increased over the two-year period. The most any subject advanced was one full stage (King et al., 1983). In another study of high school juniors, the students' mean stage score was 2.83. When these students were first-year college students, their mean stage score was 3.63 (Kitchener et al., 1989). In a meta-analysis of 14 longitudinal and cross-sectional studies using over 800 traditional-age students, high school juniors' mean stage score was 2.77 and seniors' mean stage score was 3.18 (Davison et al., 1990). Based on these findings, participants in the present study are anticipated to manifest, on average, epistemologies that can be categorized as Perry's position 3 – Multiplicity Legitimate but Subordinate.

*Patterns among first-year students.* In general, first year college students appear to function in the third stage of reflective judgment (Davison et al., 1990; Schmidt, 1985; Welfel & Davison, 1986). In the first three-year study of reflective judgment, the average stage score for traditional first-year college students was 3.36, with scores increasing to 3.56 by the junior year (Schmidt, 1985). In another longitudinal study, students' average stage score was 3.62 at college entry (with approximately one half-stage standard deviation) and 4.19 at the end of their senior year, four years later (Welfel & Davison, 1986). In the meta-analysis of 14 studies (referred to above), first-year
students’ mean stage score was 3.60 (Davison et al., 1990). Based on these findings, the average range of epistemologies manifested by participants in the present study is expected to extend from the middle of Perry’s position 2 to the middle of Perry’s position of 4.

*Patterns among college students in general.* In general, college sophomores and juniors appear to function in both the third and fourth stages of reflective judgment, while college seniors appear to function comfortably in the fourth stage. The mean reflective judgment stage scores for college students is between 3.30 and 4.07 (King et al., 1983), with college seniors scoring in higher stages than first-year students (Kitchener & King, 1981). In one study, traditional college juniors functioned in the middle of the third stage, with 85% scoring between 3 and 4.5 (Kitchener & King, 1981; Kitchener et al., 1989; Schmidt, 1985). In another study, college juniors’ mean stage score was 3.75. When these students were one year beyond college, their mean stage score was 4.18 (King et al., 1983). The reasoning of many college seniors is characteristic of Stage 4 (King & Kitchener, 2002). In the four-year study mentioned above, no student demonstrated the capacity to make judgments beyond stage 5. The majority of students were anchored in the pragmatic skepticism of Stage 4 (Welfel & Davison, 1986). In the meta-analysis of 14 studies (referred to above), college sophomores’ mean stage score was 3.40, college juniors’ mean stage score was 3.68, and college seniors’ mean stage score was 3.99 (Davison et al., 1990). These findings suggest that many of the participants in the present study may not reach full understanding of the epistemologies inherent in Perry’s last two positions until they are upperclassmen.
In sum, Kitchener, King, and colleagues' longitudinal and cross-sectional studies suggest that development through the stages of reflective judgment occurs very slowly, over many years. However, their more recent work with traditional developmental researchers indicates that contextual support or intervention in the form of scaffolding and the opportunity to practice, may propel this natural course of development forward more quickly, especially for students who are the age of the participants in the present study.

The Prototypic Reflective Judgment Interview

The PRJI method. Kitchener and colleagues (1993) conducted a study of the influence of contextual support on students' epistemological reflection. Contextual support, which will be referred to here as scaffolding and practice, is the degree of structured support, memory prompts, and opportunities for practice that prompt skills and promote the usage of more complex forms of reasoning. The Prototypic Reflective Judgment Interview (PRJI) was adapted from Kitchener and King’s Reflective Judgment Interview to provide strong scaffolding, practice, and some instructional guidance for epistemological arguments at each of the reflective judgment stages. The general format is the same as the RJI, with one addition. Before the probe questions are introduced, interviewers present participants with a dilemma-specific prototypic summary statement of each of the reflective judgment stages, one at a time, in developmental stage order to support their understanding of the increasing complexity of each of the statements. Each prototypic statement addresses the extent to which one can know for sure if a viewpoint is correct, the basis for a point of view, and an explanation for why people have different
points of view about the dilemma. In addition, each statement includes a concrete example of the dilemma. As a memory prompt, the interviewer provides a verbal introduction that informs the participants of the central constructs in the reflective judgment model (i.e. assumptions about reality, assumptions about knowledge, and concepts of justification) and how the constructs pertain to thinking in each of the stages (Kitchener et al., 1993).

Participants are then asked to explain good prototypic statements at each level of the model rather than to articulate their own thoughts and assumptions. Participants are provided a list of questions to consider as they form their summary statements. These questions direct participants’ attention to key aspects of the prototypic summary statements. Treatment participants respond to the RJI and PRJI during the first testing session, consider some examples of more adequate reasoning during an intervening two-week period, and respond to the RJI and PRJI again during the second testing session. Control participants respond only to the RJI during each testing session (Kitchener et al., 1993).

Scaffolding and practice. Contextual support in the form of scaffolding and practice is one of the most powerful environmental factors influencing cognitive development in the Piagetian well-structured problem-solving paradigm. Kitchener, King, and colleagues (1993) wondered if similar educational interventions with scaffolding and practice, provided specifically through the Prototypic Reflective Judgment Interview, could systematically promote epistemological development in the Kitchener and King ill-structured problem-solving paradigm (Kitchener & King, 1981;
Kitchener et al., 1993). They hypothesized that an individual's competence would vary depending on the conditions under which it is assessed and the degree to which environmental factors support higher levels of performance (Kitchener et al., 1993). Their finding appear below.

*Empirically-based patterns of development with scaffolding and practice.* With scaffolding and practice, individuals show relatively high levels of performance. Without scaffolding and practice, performance drops to the lower end of individuals' developmental ranges. Participants in the high scaffolding and practice condition score significantly higher than those in the low scaffolding and practice condition (Kitchener et al., 1993). Under the supportive PRJI condition, treatment participants' reflective judgment scores are higher than under the unsupported RJI condition (the treatment group mean RJI score was 4.49, their highest mean RJI score was 5.09, and their mean PRJI score was 5.25; the control group mean RJI score was 4.41 and their highest mean RJI score was 5.10). Participants who are tested under both conditions score significantly higher on the PRJI than they do on the RJI at both administrations (Kitchener et al., 1993). Important developmental spurts between the ages of 18 and 20, fostered by scaffolding and practice, are found to be deeply age-related. These spurts are more apparent under conditions that allow participants to approach their highest levels of performance (Kitchener et al., 1993). The mean age of the participants in the present study will be 19. The study will incorporate the supportive PRJI method into the design to optimize intervention participants' functioning, increase the likelihood that more rapid development occurs for them than for the control group participants, and possibly reveal
an age-related developmental spurt.

Neither the RJI nor the PRJI is a feasible or efficient measure of epistemological reflection. The costs of training RJI and PRJI interviewers, scheduling and administering individualized interviews, and transcribing and scoring the interview tapes are enormous. It is also cumbersome to implement and time-consuming to score, mitigating against its more widespread use as a measure of epistemology (Welfel & Davison, 1986; Wood et al., 2002). In sum, Kitchener and King have admitted that complex and expensive measurement tools like the RJI (and PRJI) are hard to justify (King & Kitchener, 2002). Consequently, other researchers have attempted to ameliorate some of the challenges presented by the RJI by devising similar measures. To date, these attempts have been unsuccessful. The Reflective Judgment Essay is a paper-and-pencil version of the interview that does not result in the generation of ratable data (Wood et al., 2002). Computerized Reflective Judgment Assessments have been found to be burdensome, time-consuming, fatiguing, boring, and frustrating, according to pilot participants (Wood et al., 2002). These assessments are poor at capturing participants’ opinions because they either result in an unwieldy amount of data that is difficult to rate or insufficient meaningful data to interpret. Furthermore, results show poor internal consistency. Components of a Reasoning About Current Issues Test are poorly correlated with the RJI (Wood et al., 2002). In light of these practical concerns, a more feasible and reliable paper-and-pencil measure of Perry’s positions was chosen for the present study.

Kitchener and colleagues (1993) note that researchers who expect large changes in reflective judgment over short periods of time or with minimal intervention will
probably be disappointed. The present study intends to assess change in epistemological reflection over a much longer period of time than their two-week periods. This study will also provide substantial intervention in the form of two directed, prototypic group discussions about ill-structured problems, as well as the opportunity to practice reasoning at higher Perry positions during the two-week period between these discussions. More importantly, the present study will expand on the authors’ work by combining RJI and PRJI methods with intersubjectivity to investigate associations between supportive intersubjective discussions with peers about prototypic epistemological statements and participants’ epistemological development.

*Kitchener’s Three-Level Model of Cognitive Processing*

Kitchener (1983) proposed a model that accounts for complex cognitive monitoring processes that individuals invoke when they are faced with ill-structured problems. The three-level model of cognitive processing was introduced to the discussion of and research on metacognition to emphasize the importance of epistemological assumptions underlying ill-structured problems and their solution. The model asserts that epistemic assumptions influence how individuals understand the nature of complex problems and decide what kinds of strategies are appropriate for solving them (Kitchener, 1983). Each level (i.e., cognition, metacognition, epistemic cognition) provides a foundation for the next one, but is not subsumed by it. In other words, the first level may operate independently of the second and third levels. While the second level operates in conjunction with the first level and apart from the third level, the third level must operate in conjunction with both the first and second levels. All three levels are
necessary to account for the complex monitoring that is involved when older adolescents and adults are faced with the ill-structured problems of everyday life (King & Kitchener, 2002; Kitchener, 1983). Each of the three levels will be described below.

**The Three Levels**

**Cognition.** Cognition is the first level. Individuals employ cognitive processes to compute, memorize, read, perceive, and solve problems. Cognition appears to develop in childhood and is used throughout the life span (Kitchener, 1983).

**Metacognition.** The second level, metacognition, allows individuals to monitor cognitive and metacognitive processes (King & Kitchener, 2002) as well as their own progress when they are engaged in the first-order processes of cognition during problem-solving tasks (King & Kitchener, 2002; Kitchener, 1983; Kitchener et al., 1989). This self-monitoring of cognitive processes includes three parts: (a) knowledge about self and others as cognitive processors when they are engaged in tasks, (b) knowledge about specific cognitive tasks themselves, and (c) metacognitive experiences of puzzlement which lead to the re-evaluation of cognitive strategies (Kitchener, 1983). Metacognition begins to develop in childhood, is common by early adolescence, and is used actively throughout the remainder of the life span. It is important to note here that metacognition is believed to be fully developed by late adolescence (Kitchener, 1983).

**Epistemic cognition.** The third level in the model is epistemic cognition. It emerges and develops during the late adolescent and adult years. Epistemic cognition is the foundation of critical thinking when individuals are engaged in ill-structured problem solving because it enables individuals to reflect on the limits of knowing, the certainty of
knowing, and criteria of knowing (King & Kitchener, 2002; Kitchener, 1983). Epistemic assumptions influence how individuals understand the nature of different problem types and identify, choose, and evaluate alternative strategies and solutions that are appropriate for solving them. This meta-meta level of cognition leads individuals to interpret the nature of a problem and to define the limits of any strategy in solving it (Kitchener, 1983).

The Role of Metacognition in Epistemological Development

According to the three level model, metacognition leads individuals to use different cognitive strategies and to redefine tasks, but it is not sufficient to describe the monitoring that individuals invoke when they make thoughtful decisions about ill-structured problems. Rather, the higher level of meta-meta-cognitive monitoring, found in epistemic cognition (e.g., processes that monitor the epistemic nature of problems and the truth value of alternative solutions), is necessary (Kitchener, 1983). A complete model of cognitive monitoring in ill-structured problem solving must recognize that individuals hold different epistemic assumptions. These assumptions develop in late adolescence and adulthood, and the differences in assumptions that ensue lead individuals faced with ill-structured problems to use different epistemic cognitive processes surrounding the nature of problems and the limits of their solution.

Epistemic cognitive processes cannot operate in isolation from cognition or metacognition. Epistemic processes must be understood to operate in combination with metacognitive processes to account for the kind of monitoring individuals engage in when they consider and solve ill-structured problems. Therefore, epistemic cognition,
according to the three-level model, depends on the metacognitive processes that monitor progress in solving ill-structured problems (Kitchener, 1983). Kitchener proposed this model in 1983, but has never empirically tested it; therefore, no supporting evidence is available to determine its validity. The present study will include a measure of metacognitive awareness to account for the possible contribution of metacognition as an explanatory variable operating in the epistemological developmental process.

**Metacognitive Awareness.** While metacognition is broadly defined as the ability to reflect upon, understand, and control cognition, Schraw and Dennison (1994) define metacognitive awareness as the ability to plan, sequence, and monitor one's thinking and learning in a way that directly improves performance. Metacognitive awareness is believed to intensify as cognitive tasks increase in difficulty, partly because complex tasks require more deliberate and self-regulated monitoring than highly automated cognitive processing. Therefore, metacognitive awareness is an essential aspect of monitoring accuracy when individuals are engaged in ill-structured problem-solving tasks (Schraw & Dennison, 1994). The specific metacognitive awareness sub-processes that facilitate the regulation of cognition include planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation. These sub-processes correspond to knowledge about the ways to approach problems, implement strategies, monitor the effectiveness of solutions, correct comprehension errors, and evaluate learning as it transpires (Schraw & Dennison, 1994). Both Kitchener's (1983) three-level model and Schraw and Dennison's (1994) theses about metacognition serve as the basis for the hypothesis that metacognitive awareness will moderate epistemological
development for participants who engage in intersubjective, prototypic discussions about ill-structured problems during intervention sessions in the present study.

Research Questions

The primary focus of this paper is to examine if epistemological reflection develops during the first year of college, if it develops to a greater extent for treatment participants, and if intersubjectivity and/or metacognitive awareness moderate epistemological development. Specifically, the following research questions will be examined:

1. Does epistemological reflection develop significantly among first-year at-risk honors college students? Based on the patterns of previous empirical findings, most participants are expected to function at higher Perry positions by March of their first year at college than before they entered college.

2. Does epistemological reflection develop significantly more among treatment participants than control participants? Treatment participants will engage in intersubjective peer group discussions that provide scaffolding and practice. Theoretically and empirically, the intersubjective process, scaffolding, and practice promote development; therefore, it is expected that treatment participants will function at higher Perry positions than control participants both in December after the intervention, and in March.

3. Does epistemological reflection develop significantly more among treatment participants who have higher rates of program participation? If participants attend more sessions, they may be exposed to a greater number of thoughts that show flaws in their
present thinking. This exposure could incite disequilibration through cognitive conflict, assimilation of new ideas and accommodation of old reasoning structures, and ultimately more sound hierarchically-complex, and sophisticated epistemologies. It is expected that these treatment participants will function at higher Perry positions after the intervention than participants who attend fewer discussion sessions.

4a. Do treatment participants self-report experiencing intersubjectivity during the peer pressure, academic expectations, and both cognitive development intervention sessions? Previously, intersubjectivity has been operationally defined as reasoning accepted or the agreement between reasoning exposed to and reasoning adopted. Thus, it has been an observational measure examining if children are exposed to, and subsequently adopt, the reasoning of another person. In this study, young-adult participants are expected to be able to self-report both that they have been exposed to and that they will adopt the reasoning of other members of their treatment group during and after discussions of topics that are believed to lead to exposure to new perspectives.

4b. Is self-reported intersubjectivity positively associated with program participation? If participants attend more sessions, they may become more familiar with each other. If they are more familiar with each other, it is possible that the intersubjective process will be facilitated. They may begin the problem-solving discussions with different understandings, yet arrive at shared understanding more rapidly in the course of communication with each other because their discussions may be more imbued with differing viewpoints, an optimal balance in cognitive conflict, an openness and willingness to disagree, and constructive discourse features, all of which optimize the
intersubjective process. More program participation is anticipated to be positively correlated with intersubjectivity.

4c. Does self-reported intersubjectivity moderate change in epistemological reflection? Theoretically and empirically, greater intersubjectivity leads to greater cognitive development when peers who reason at differing levels of complexity are instructed to reach agreement in solving a problem. Epistemological development is expected to depend on the intersubjective process such that, on average, the highest Perry positions after the intervention will be found among participants who self-report experiencing higher degrees of intersubjectivity.

5a. Do self-reported intersubjectivity and metacognitive awareness moderate change in epistemological reflection together or independently? Kitchener (1983) proposed that epistemic processes must be understood to operate in combination with metacognitive processes to account for the kind of monitoring individuals engage in when they consider and solve ill-structured problems. However, this proposition has never been tested. The present study will undertake an exploratory test of the possible contribution of metacognitive awareness in the epistemological developmental process. It will seek to clarify if metacognitive awareness does indeed contribute to the epistemological development process in a moderating manner and whether its’ effects can be demonstrated in conjunction with or separately from the effects of intersubjectivity.

5b. Does metacognitive awareness differentially moderate change in epistemological reflection for treatment and control participants? Theoretically,
epistemic cognition, according to the three-level model, depends on the metacognitive processes that monitor progress in considering and solving ill-structured problems. If metacognitive awareness contributes to the epistemological development process, then greater epistemological development among treatment participants is expected to depend on greater metacognitive awareness such that, on average, the highest Perry positions after the intervention will be found among treatment participants who report higher levels of metacognitive awareness, while the lowest Perry positions after the intervention will be found among control participants who report lower levels of metacognitive awareness.
CHAPTER III

METHODS

Sample

Criteria for Inclusion

There were 472 at-risk honors students (mean age = 19) entering the University of Arizona in the Fall of 2003. Students who belong to this heterogeneous risk group were classified as at-risk because they were either minority students or students from predominantly minority schools (i.e., primarily Hispanic schools), Native Americans from reservation schools, students from rural schools, first-generation college students, transfer students (whose GPAs usually drop one point during the transition), younger than average students (i.e., younger than 16), or students from schools with less rigorous academic programs. All of these categories of students typically endure a harder transition to college. The demographics of the recruited sample appear in Table 1.

Recruitment Procedure

In July of 2003, all 472 incoming at-risk honors students who fit the selection criteria were mailed the following: (a) an introductory letter describing the project and assuring confidentiality; (b) a consent form (a parental assent form was obtained from the one student who was younger than 16); (c) a seven-measure questionnaire packet; (d) an open-ended Measure of Epistemological Development; (e) an availability schedule, and (f) a self-addressed stamped return envelope. Pilot participants' responses and comments were used to modify instructions, items, or phrases within items, where necessary and appropriate. The summer measurement-completion pilot study indicated that the
approximate completion time for both sets of measures combined was one hour.

No monetary compensation was offered to students who volunteered to participate. Instead, volunteers for the study were offered priority academic advising, provided free food and soda during sessions, given a free t-shirt, and provided with pizza at the December and March questionnaire completion sessions. Additionally, participants were afforded the opportunity for any kind of personal attention from the Honors staff, if requested, throughout the course of their first year at the University.

Thirty-nine students initially returned signed consent forms and completed questionnaires; therefore, it was necessary to expend additional energy to encourage more students to return materials and volunteer to participate in the study. Three follow-up recruitment phases took place during the month preceding students' enrollment in the University. Students who were included in these follow-up recruitment efforts were contacted because they were (a) first-year students who attended an orientation session, (b) provided the University with an e-mail address or phone number, and (c) did not respond to recruitment contacts by refusing to participate in the study.

Two weeks after the initial mailing, 285 students were contacted by e-mail (19 were telephoned) and encouraged to return materials. Eighteen more signed consent forms and completed questionnaires were received in response to this first follow-up contact. Two weeks after the first follow-up contact, 261 students were e-mailed (12 were called) again and encouraged to participate. Fifteen more signed consent forms and completed questionnaires were received in response to this second follow-up contact. After two more weeks, 221 students were e-mailed (none were called) one last time.
Eleven more signed consent forms and completed questionnaires were received in response to this third follow-up contact. A total of 83 students volunteered to participate in the study before the Fall semester commenced.

Sample Description

The mean age of the 83 participants was 18 years, 10 months in August ($SD = 2$ years, six months). A majority of the participants were between 18 and 19 (72.1%), with twelve students younger than 18, and six students 19 or older. Approximately two-thirds of the students were women ($N = 57; 69\%$). The pilot study, as well as previous programs, indicated that this gender composition was typical for this type of intervention (Pratt et al., 2000). The demographics of the participating sample suggest that it is a relatively representative sub-group of the recruited sample (see Table 1).

As noted, this was one of the first studies to focus on a heterogeneous sample of under-represented students. In terms of racial diversity, approximately half of the participants were non-white ($N = 42$). More specifically, 18% were Asian ($N = 15$), 13% were Hispanic ($N = 11$), and 16% were multi-racial ($N = 13$). While about 11% of the sample spoke a mixture of English and non-English at home ($N = 9$), 84% spoke mostly English at home ($N = 70$). A small proportion of the participants either were not born in the United States ($9.64\%; N = 8$) or were first-generation college students ($14.46\%; N = 12$).

Design

The methodological components of this dissertation were extended from the research done by King, Kitchener, and colleagues (King et al., 1983; King & Kitchener,
1994, 2002; Kitchener et al., 1993), Baxter-Magolda (Baxter-Magolda & Porterfield, 1985; Baxter-Magolda, 1987), and Moore (1989, 1990). The design of the larger Paladins Project was an extension of the work of Pratt and colleagues (Hunsberger, Pancer, Pratt, Rog, & Alisat, 2001; Pratt et al., 2000). Both the dissertation and the Paladins Project were approved by the University of Arizona Social and Behavioral Sciences Human Subjects Committee. A pilot of the Paladins Project, comprised of a group of eight first-year at-risk honors students during the 2002-2003 academic year, indicated that the overall structure of the program was appropriate for this sample. Timing of certain sessions was changed to accommodate a U.S. rather than Canadian academic calendar. Through the pilot study, redundant sessions and peripheral measures were identified and deleted from the Paladins Project to permit the incorporation of the cognitive development intervention sessions and associated dissertation measures. The following is a description of the methods of this dissertation.

Training Co-Facilitators

Co-facilitators trained by the Principal Investigator included four undergraduate students (3 women) and one Honors College administrative staff member. Two of the co-facilitators participated in the pilot project during their first semester at the University in 2002. All five co-facilitators, regardless of previous experience, were exposed to the same preparation. Before training meetings, co-facilitators were asked to read materials related to active listening and interviewing skills. The training meetings were devoted to detailed discussions of the reading materials, co-facilitators’ roles, and the tasks that would take place during discussion sessions. During training meetings, co-facilitators
had an opportunity to actively lead simulated discussions and play the role of group members. Additional feedback was provided to co-facilitators by the Principal Investigator after each discussion session.

**July Pre-Test Measurement Administration**

During July of 2003, participants completed the pre-test measures, which included the Measure of Epistemological Development, a series of demographic questions about gender, age, ethnicity, language spoken at home, generational status, first-generation college student status, 12th grade GPA, and intended major (see Appendices B and C).

**Group Assignment**

Recruited participants who returned signed consent forms and completed questionnaires were assigned either to the questionnaire-only control group (N = 33) or to a treatment discussion group (N = 50). Comparisons of the treatment and control group appear in Table 2. The pilot study suggested that scheduling students to discussion groups would be difficult and that attrition might cause the sample to decrease by at least 20%. That is, it was estimated that if 12 persons were available for and assigned to each discussion group, only 9 would be expected to be retained by the end of the semester. Therefore, an attempt was made to assign more than ten students to each discussion group to enhance group dynamics in discussion sessions throughout the semester. In addition, an attempt was made to assign at least three males to each discussion group to ensure a sufficient mixture of genders in each group. Thus, more males were necessarily assigned to the treatment group (N = 16) than to the control group (N = 10). This strategy has been found to enhance the likelihood that all participants would feel comfortable
enough to talk (Pratt et al., 2000). Compositions of each discussion group and the control group appear in Table 3.

While data are not available from previous research to indicate whether demographic characteristics would influence group dynamics, the theoretical underpinnings of the intersubjectivity construct suggest that demographic diversity would stimulate discussion of a wide range of views. Therefore, no attempt was made to create single-race groups. Furthermore, common experiences at the same university are known to override variations in epistemological development students may experience because of their differing academic disciplines (Welfel & Davison, 1986). Therefore, no attempt was made to create groups based on academic major.

**Introductory Interview**

Each participant who was assigned to a discussion group met independently with the Principal Investigator for 10 to 15 minutes during the first week of classes to raise the comfort level between participants and the lead facilitator. These introductory interviews were intended to serve as an information-sharing getting-to-know-you session, therefore, no data was collected at that time.

**Discussion Sessions One through Five**

For eight weeks during the Fall semester of 2003, topic-specific Paladins Program group discussions took place (weekly for the first four sessions, bi-weekly for the latter four sessions). Sessions lasted approximately 90 minutes. Each session began with a short informal chat (i.e., check-in period) while awaiting all members' arrival, followed by an exercise that was focused on the day's topic, a more open discussion that was
guided by a series of pre-set questions, a pencil-and-paper evaluation of the discussion and facilitators' fidelity to the structure of the session, and a wrap-up and brief introduction of the next session (Hunsberger et al., 2001). The pilot study confirmed that the duration and design of these discussion sessions were effective at covering the designated material and maintaining students' interests.

The primary goal of the first Paladins discussion session was to introduce group members to one another and to the study. The focus of conversation during the second Paladins session was on establishing new social ties (i.e., ties with peers with whom participants could share feelings about the novel experiences and the new environment) and joining clubs and organizations. The third Paladins discussion session concentrated on adaptive methods to balance academic demands with a social life.

The fourth Paladins session provided concrete tools for students as they face peer pressure and offered support for their vastly different values. Each member was encouraged to talk during the check-in period of this session in order to become comfortable with sharing their individual viewpoints. Hypothetical values vignettes about diversity, religion, delinquency, drinking, drugs, and sex, borrowed from the pilot study and previous programs, or generated by members of the group during session three, were read aloud. Participants engaged in a brainstorming session about how to handle peer pressure and appreciate others' values. Participants were asked to answer the two self-report intersubjectivity items, created for purposes of the present study, at the conclusion of this session.

The general discussion of the fifth Paladins session focused on sharing different
expectations group members may have had prior to coming to the university (e.g., expectations about the nature of classes and coursework, professors’ methods of teaching, students’ roles in the learning process, grading, group work), and their subsequent experiences in relation to those expectations. Participants, once again, answered the two self-report intersubjectivity items that were used in the present study’s analyses.

Discussion Session Six – Cognitive Development Intervention

Discussion about the effects of chemical additives on foods (see Appendix A). The Principal Investigator began the first cognitive development intervention session, after the short informal check-in period, by reading instructions that delineated the plan for the session. Participants were encouraged to feel free to disagree with each other during this conversation, yet it was noted that the goal of this session was that everyone would reach agreement by the end. Then, participants were offered an opportunity to ask clarifying questions.

Then, the Principal Investigator provided epistemological-reflection scaffolding by introducing King and Kitchener’s (2002) seven stages of reflective judgment to participants, verbally and in writing (Kitchener et al., 1993). Descriptions of each of the reflective judgment stages addressed the basis for the point of view in each stage, the extent to which persons who function within each stage can know for sure their viewpoint is correct, and an explanation about why persons who function within each stage think people have different points of view (Kitchener et al., 1993).

Next, the cognitive development intervention discussion consisted of one of the intellectual dilemmas created by Kitchener and King for the Reflective Judgment
Interview (King & Kitchener, 2002; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989; Wood et al., 2002) presented by the Principal Investigator in a semi-structured group discussion format. The dilemma was defined by two conflicting and contradictory points of view on an issue. It represented an intellectual domain about which most participants would be familiar and it explicitly referred to the fact that disagreement exists about its solution. It was noted that, in many cases, qualified experts from different perspectives endorse opposing positions. The dilemma presented in this session follows:

There have been frequent reports about the relationship between chemicals that are added to foods and the safety of these foods. Some studies indicate that such chemicals can cause cancer, making these foods unsafe to eat. Other studies, however, show that chemical additives are not harmful, and actually make the foods containing them more safe to eat.

After the dilemma was read aloud, participants were invited to think for a few moments about the dilemma in conjunction with the Kitchener and King stages. All participants were encouraged to state and try to justify the most complex form of thinking they understood, as it applied to the dilemma. The Principal Investigator continued to ask a standardized series of probe questions, which were created by Kitchener and King for the Reflective Judgment Interview (King & Kitchener, 2002; King et al., 1983; Kitchener et al., 1989; Wood et al., 2002) and adapted by Kitchener and colleagues (1993) for the Prototypic Reflective Judgment Interview. The prototypic reflective judgment questions were designed to elicit (a) dilemma-specific statements regarding participants’ most sophisticated views about the nature of knowledge, (b) use of evidence and reasoning to
support their points of view on the dilemma, (c) opinions about the role of authorities or experts in resolving the ongoing controversy about the dilemma, and (d) openness to alternative frames of reference in relation to the dilemma (King & Kitchener, 2002; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989; Wood et al., 2002) (see Appendix A). The dilemma-specific aspects of reflective judgment that were elicited by these seven prototypic reflective judgment questions are similar to, but not identical with Perry’s epistemological reflection. Thus, post-test responses on the Measure of Epistemological Development were expected to be unbiased by this intervention session.

Throughout the rest of the conversation, members of the group were encouraged to feel free to openly disagree with each other (e.g., offer explanations, constructively criticize each other, defend their opinions, question each other, dispute disagreements, and state inferences drawn through the discussion). Participants were reminded that the goal, by the end of the discussion, was that everyone would reach agreement on the most complex form of reasoning everyone could take in thinking about the dilemma. The final question the facilitators posed was, “Now, can you all agree on the most complex point of view to take in thinking about this subject?” Participants discussed their views until agreement was reached.

After agreement was reached, participants completed the pencil-and-paper evaluation of the session and facilitators’ fidelity to the structure of the discussion, which also consisted of two self-report intersubjectivity items. Upon completion of this form, participants were presented with concrete dilemma-specific, prototypic summary statements from each of Kitchener and King’s seven theoretical stages. The written
statements, which participants took, were intended to provide strong scaffolding for arguments about the dilemma at each of Kitchener and King's stages and to afford participants the opportunity to practice these arguments with other peers between sessions (Kitchener et al., 1993). A wrap-up and brief introduction of the next session concluded this session.

Discussion Session Seven – Cognitive Development Intervention

Discussion about the construction of the pyramids (see Appendix A). After the short check-in period, the Principal Investigator began the second cognitive development intervention session in the same manner as session six, by reading aloud instructions that delineated the plan for the session, encouraging participants to feel free to disagree with each other during this conversation, noting that the goal of this session was that everyone would reach agreement by the end, and offering an opportunity for participants to ask clarifying questions.

The Principal Investigator, once again, provided epistemological-reflection scaffolding through introducing Kitchener and King's seven theoretical stages to participants, verbally and in writing (Kitchener et al., 1993). Descriptions of each of the stages were the same as in the first cognitive development intervention session. The discussion consisted of another intellectual dilemma created by Kitchener and King (King & Kitchener, 2002; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989; Wood et al., 2002) in the same manner as in session six. The dilemma used in this session follows:

Most historians claim that the pyramids were built as tombs for kings by the ancient Egyptians, using human labor, and
aided by ropes, pulleys, and rollers. Others have suggested that the Egyptians could not have built such huge structures by themselves, for they had neither the mathematical knowledge, the necessary tools, nor an adequate source of power.

After the dilemma was read aloud, participants were invited to briefly think about the dilemma and the Kitchener and King stages. All participants were subsequently encouraged to state and justify the most complex form of thinking they understood, as it applied to the dilemma. The Principal Investigator continued to ask the standardized series of seven prototypic reflective judgment probe questions (see Appendix A).

As in the first cognitive development intervention session, members of the group were encouraged to feel free to openly disagree with each other. Participants were reminded again that the goal was that agreement would be reached on the most complex point of view to take in thinking about the dilemma.

After agreement was reached, participants completed the evaluation and the two self-report intersubjectivity items. Another set of concrete dilemma-specific, prototypic summary statements from each of Kitchener and King’s seven theoretical stages was presented. The statements were intended to provide strong scaffolding for arguments about the issue at each of Kitchener and King’s stages and to afford participants the opportunity to practice these arguments with other peers outside of the group (Kitchener et al., 1993). A wrap-up and brief introduction of the next session concluded this session.

Discussion Session Eight

The last Paladins discussion session was deliberately timed to occur before the Thanksgiving weekend, when most students would be returning home, possibly for the first time since classes began. The rationale was to give participants a chance to reflect
on and discuss their ideas, apprehensions, and excitement about going home.

*December Post-Test Measurement Administration*

Post-participation questionnaires were administered to all discussion-group participants during their regularly scheduled group meeting times in December of 2003. These treatment group participants completed the Measure of Epistemological Development, the Metacognitive Awareness Inventory Regulation of Cognition Sub-Scale, and group discussion evaluation forms. Questionnaire-only control group participants completed the same questionnaires, with the exception of the discussion evaluation forms, in one location at various times during the first week of December, 2003. The summer measurement-completion pilot study indicated that the questionnaire session would last approximately one hour.

*March Follow-Up Measurement Administration*

Follow-up questionnaires were administered to participants in one location at various times during the first week of March, 2004. These participants completed the Measure of Epistemological Development.

*Measures*

*Demographic Measures*

Although changes in epistemological reflection have not been accounted for in previous empirical studies by any of the following variables, these variables were included in the present study to describe the sample and to test whether similar patterns of results would hold for this sample. Participants were asked to self-report *gender* (1 = male; 2 = female), *age* (coded by number of months), *ethnicity* (1 = Black; 2 = Native-
American; 3 = Caucasian or White; 4 = Asian American or Asian; 5 = Hispanic or Latino; 6 = Other; 7 = More than One Race) (see Appendix B for sub-categories within each ethnicity), predominant language spoken at home (1 = mostly English; 2 = a mixture of English and Non-English; 3 = mostly Non-English), 12th grade GPA (coded to the hundredths), and intended major (1 = liberal arts, social science, humanities; 2 = science, engineering; 3 = undecided).

University electronic student academic information files were reviewed for high school location (1 = urban; 2 = rural), year in college (1 = freshman, 2 = sophomore, 3 = junior, 4 = senior), first semester courses (1 = small/lab classes of fewer than 20 students, 2 = medium sized classes of 20 to 29 students, 3 = large general education classes of 30 students or more) and highest SAT verbal score. When SAT verbal scores were not available and ACT scores were, ACT equivalents were based on the Educational Testing Service’s ACT to SATI Conversion Table. Because the conversion table lists the combined SAT verbal and math scores, conversions were halved (with half-scores ending in ‘5’) for purposes of this study to reflect that an estimated verbal SAT was computed. It should be noted that IRB approval and participants’ consent were granted to obtain this demographic and academic information.

Epistemological Reflection

Epistemological reflection, defined by Perry (1970, 1981) as development in thought about the nature of knowledge, was measured by the Measure of Epistemological Development (MED). The MED, derived from Baxter-Magolda’s Measure of Epistemological Reflection (Baxter-Magolda & Porterfield, 1985; Baxter-Magolda,
is an open-ended, paper-and-pencil instrument that addresses five domains of thinking. These domains include: the role of the learner, the role of the instructor, the role of peers, the role of evaluation, and the nature of knowledge (see Appendix C). Each domain was measured by a series of questions headed by a stem to focus participants’ thinking on the domain. Three to four follow-up probes encouraged elaboration of and elicited specific justification for participants’ thinking. For example, questions on the role-of-peers domain began with the stem Do you prefer classes in which students talk a lot or don’t talk very much? Through the follow-up probes, participants were asked why the chosen degree of involvement of peers was preferred, its advantages and disadvantages, and what type of interaction participants liked to see among members of a class to enhance their learning.

Previous research as well as the pilot study indicated that the MED would take 30 minutes to one hour to complete (Baxter-Magolda & Porterfield, 1985; Baxter-Magolda, 1987). Reliability of the MED, using the original rating system, has been established in previous studies through interrater reliability (.80) and internal consistency (.74) (Baxter-Magolda & Porterfield, 1985; Baxter-Magolda, 1987, 2001). Internal consistency in this study was good (α for each time point was .74, .61, and .69, respectively). The MED was used in research questions 1, 2, 3, 4c, 5a, and 5b.

MED responses were rated according to procedures delineated for the Measure of Intellectual Development because the MID Instrument Manual revealed a rating system that would offer more refined codes than the original scoring of the MER (see Appendix G; Moore, 1990). Furthermore, the MID system extends the Perry continuum from 4
positions (i.e., positions 2, 3, 4, and 5) to 10 positions in a manner that more directly assesses transitions between positions (Moore, 1990). Specifically, the scoring paradigm involves determining a dominant and (if necessary) subdominant reasoning structure within each of the five MED domains and assigning a three-digit Perry position to each of the domains, on the basis of Perry's (1970) original description of the scheme (Baxter-Magolda & Porterfield, 1985; Baxter-Magolda, 1987; Moore, 1989; Moore, 1990). As examples, a 223 represents dominant position 2 opening to position 3, while 233 indicates dominant position 3 with trailing position 2, and 333 reflects a stable position 3 perspective (Moore, 1990). In addition, unlike the MER scoring, the MED ratings focus on the content and language of responses, which also enhances accuracy in measuring epistemological reflection.

Raters separated participants' responses by domain and assessed one domain across all participants before proceeding to the next domain. Specifically, raters identified the dominant and (if necessary) subdominant reasoning structure in a domain and compared the structure to Perry's epistemological reflection position descriptions and examples provided by Moore (e.g., from Perry position 4 for the 'role of peers' domain, peers share and learn each others' viewpoints in order to gain diverse perspectives and to think independently). Raters then chose the Perry position that most closely matched the participant's dominant and (if necessary) subdominant reasoning structure for the domain and assigned a three-digit rating that corresponds to the Perry positions (i.e., 1 = dualism through 5 = contextual relativism). It should be noted that assigning a dominant and subdominant position for each domain is believed to be appropriate because the
compilation of five domain ratings into an average total score provides for the possibility that participants exhibit transitional responses in more than one Perry position across all of the domains (Baxter-Magolda, 1987; Moore, 1990). After each domain rating was assigned, a total protocol rating (TPR) or overall MED score was derived for each participant by averaging the ratings for all five, equally-weighted domains. Moore (1990) asserts that it is both acceptable and reasonable to treat the Perry continuum as an interval scale for purposes of data analysis; therefore, ratings were converted to numerical scores, such that a 223 became 2.33, a 233 became 2.67, and a 333 became 3.00. Converted TPR ratings ranged from 1.00 to 5.00 (e.g., a TPR of 2.33 would indicate that a participant was functioning from a dominant position 2 perspective, opening to position 3, while a TPR of 2.67 would indicate that a participant was functioning from a dominant position 3 perspective, with trailing position 2, and a TPR of 3.00 would indicate that a participant was functioning from a stable position 3 perspective).

The MED was administered in July of 2003 to determine pre-test levels of epistemological reflection, again in December of 2003 to assess the degree to which epistemological reflection changed, and once more in March of 2004 to measure if changes in epistemological reflection were temporary or lasting. As noted above, the aspects of reflective judgment that were elicited by the dilemma-specific prototypic reflective judgment questions in the cognitive development intervention sessions were similar, but not identical to epistemological reflection, which the MED measures. Thus, the cognitive development intervention sessions were not expected to bias participants'
responses on the MED. Furthermore, as in previous studies of cognitive development (Lamborn, Fischer, & Pipp, 1994), this study separates problem solving from understanding, providing independent assessment of understanding (i.e., the ability to independently generate statements that reflect construction of one’s own thoughts) through the MED. Repeated administration of the MED is not anticipated to result in invalid results because participants’ responses are likely to differ across measurements in association with their epistemological development, rather than as a consequence of testing effects.

In terms of the reliability of the MID scoring system, Moore (1990) recommends that raters compute two figures for interrater reliability. The first figure, referred to as absolute agreement, is the percentage of the responses on which raters produce identical initial ratings. The second figure is called the within 1/3 position agreement figure (i.e., the percentage of responses on which raters’ individual ratings are 1/3 position or less different). For simplicity, Moore (1990) uses the within 1/3 position figure and expects to see the level of reliability between raters consistently at 90% or higher.

Two raters in the present study included the Principal Investigator and one graduate student in Family Studies and Human Development. Training entailed reading chapters written about the Perry scheme by Perry (1981) and Baxter-Magolda (Baxter-Magolda & Porterfield, 1985; Baxter-Magolda, 1987) and a rating manual written by Moore (1990). The raters in this study scored 50% of the sample’s responses and discussed discrepancies in scores until an average of approximately 90% agreement was reached. The remaining half of the data was concurrently and independently scored by
the Principal Investigator. Nine pre-test interrater reliability scores ranged from 76% within 1/3 position agreement during the first check, to 97% by the eighth check. The 90% threshold was reached by the fifth pre-test reliability check. Six post-test interrater reliability scores ranged from 89% to 100% within 1/3 position agreement. The 90% threshold was reached at the first post-test reliability check. Three follow-up post-test interrater reliability scores ranged from 97% to 100%.

Intersubjectivity

As noted in the previous chapter, intersubjectivity has been assessed empirically in observational studies of the impact of peer interactions on children’s cognitive development (Tudge, 1989, 1992; Tudge et al., 1996). In this paradigm, children between 5 and 9 years of age are pre-tested individually on their rule-based thinking and assigned to one of three treatment conditions. The control group is comprised of children who do not work with a partner. The equal rule group consists of pairs of children who used the same rule at pre-test. The unequal rule group is composed of pairs of children who used different rules at pre-test (Tudge, 1989, 1992; Tudge et al., 1996). In the treatment phase, pairs are instructed to justify their predictions about the movement of the balance beam and discuss their reasons until they reach agreement on one prediction.

In this previous empirical work, intersubjectivity has been operationally defined as reasoning accepted or the concurrence between exposure to reasoning and adoption of reasoning, under the condition that the post-test reasoning differs from that used at pretest. Children were categorized by the researcher either as acceptors of their partners’ reasoning (if they had been exposed to and had adopted others’ reasoning) or as
nonacceptors (if they had been exposed to but did not adopt others' reasoning) (Tudge, 1989, 1992; Tudge et al., 1996). Unlike the observational, categorical measure used in previous research with children (Tudge, 1992), intersubjectivity in the present study of older adolescents was a self-reported continuous variable.

In this study, intersubjectivity was operationally defined as the degree of agreement between the reasoning participants perceived to have been exposed to and the reasoning participants perceived they would adopt and use as their own after reaching agreement with peers through ill-structured problem-solving discussion. Two self-reported intersubjectivity items were created for purposes of this study (see Appendix D). The exposure to reasoning item asked participants to rate the degree to which they perceived themselves to be exposed to new ways of thinking during discussions (see Appendix D). Response options ranged from 0 = not at all to 10 = fully. The adopted reasoning item asked participants to rate the degree to which they perceived they would adopt others' ways of thinking after the discussion (see Appendix D). Response options ranged from 0 = not at all to 10 = fully. These items were presented to treatment group participants after the personal values and peer pressure session, the academic expectations and reality session, and both of the cognitive development intervention sessions.

Intersubjectivity was coded as the degree of agreement between the rating of the exposure to reasoning item and the rating of the adopted reasoning item. Scores were computed as follows: if the exposure rating was greater than the adopted rating, then there was a negative intersubjectivity difference score; if the exposure and adopted
ratings were equal, then there was a 0 intersubjectivity score; if the exposure rating was less than the adopted rating, then there was a positive intersubjectivity difference score. Scores could range from $-10$ to $+10$, with 0 as the midpoint. There were four computed intersubjectivity scores for each participant (i.e., one for each of the sessions in which intersubjectivity was measured). The two intersubjectivity scores from the cognitive development intervention sessions were combined to compute a cognitive intersubjectivity score for each participant. The scores from the four sessions during which intersubjectivity was measured were combined to compute a mean intersubjectivity score across all four sessions for each participant.

**Intersubjective Milieu**

Six theoretically exploratory items were created to assess if the interpersonal conditions for intersubjectivity were present during the discussions. These items measured the six aspects of peer interactions that are thought to promote intersubjectivity and epistemological development. The items selected were derived from theoretical discussions about and operational definitions of intersubjectivity (Tudge, 1989, 1992; Tudge et al., 1996) (see Appendix E). Participants were asked to rate the degree to which they perceived each of these aspects to be present during the group discussions, with response options ranging from $0 = \text{not at all}$ to $10 = \text{fully}$. The items were included in the standard post-session pencil-and-paper evaluation forms for every session. Six intersubjective milieu mean scores were computed for each treatment participant by averaging responses to each of the items across all eight sessions. These six item-specific mean scores were combined and averaged to create a mean intersubjective milieu score.
for each participant. Internal consistency statistics indicated that the intersubjective milieu items were highly intercorrelated (α = .93) and that the six items that measured each of the aspects of peer interactions were consistent across time (α ranged from .82 to .90).

While program participation tallies indicate the number of sessions in which participants were present, intersubjective milieu could possibly represent some sort of active or enabled participation in discussions. If the items are intercorrelated, the mean intersubjective milieu scores may be used in combination with or in lieu of participation tallies in research questions 3 and 4b. It is possible that more active and enabled participation would be correlated with higher rates of change in epistemological reflection (similar to the hypothesis implied through research question 3). Furthermore, it is possible that more active and enabled participation would be correlated with higher intersubjectivity scores (as in research question 4b).

Metacognitive Awareness

Metacognitive awareness allows individuals to regulate cognition by planning, sequencing, and monitoring cognition in a way that directly improves performance. In this study, metacognitive awareness was assessed only in December of 2003 through the 35-item self-report Metacognitive Awareness Inventory, Regulation of Cognition Sub-Scale (Schraw & Dennison, 1994). The specific sub-processes that facilitate the regulation of cognition include planning, information management strategies, monitoring, debugging strategies, and evaluation (Schraw & Dennison, 1994). Items that represent each of these sub-processes are listed in Appendix F. Participants were asked to rate the
degree to which each item applied to them (1 = doesn't apply to me at all to 10 = applies very closely to me). Ratings on the items were averaged for each person. Metacognitive awareness was used in research questions 5a and 5b.

This measure of metacognition has been found to be easily administered and suitable for adolescents and adults. Internal consistency in the present study was high (α = .93). Coefficient alpha for items loading on the regulation of cognition factor reached .91 in a previous study, also indicating a high degree of internal consistency (Schraw & Dennison, 1994). The authors of that study believe the predictive validity of the measure may increase as cognitive tasks increase in difficulty because metacognitive awareness may play a greater role in the performance of such complex tasks than automated cognitive functions and because more individual variation occurs in ill-structured problem-solving tasks (Schraw & Dennison, 1994).

Plan of Analysis

Research Question 1

It is hypothesized that epistemological reflection will develop significantly among first-year at-risk honors students during their first year of college. Raw difference scores will be used to assess whether MED scores increase more than .10 of a stage between July pre-test and December post-test measurement administration and between July pre-test and March follow-up measurement administration. This degree of difference in stage scores is consistent with the threshold previously established by King and Kitchener (1994). Descriptive statistics will be used to determine if, on average, significant epistemological development occurs.
**Research Question 2**

It is hypothesized that epistemological reflection will develop significantly more among treatment participants than control participants. Group differences at post-test will be assessed using a t-test. Group differences at follow-up will be assessed using a 2 (condition: control, treatment) x 3 (time: July pre-test, December post-test, March follow-up) repeated-measures MANOVA.

**Research Question 3**

It is hypothesized that epistemological reflection will develop to a greater extent among treatment participants who have higher rates of program participation. Associations between rates of program participation and epistemological development at the December post-test and March follow-up measurement administrations will be assessed using correlations, as follows.

- $\text{EDDec (i.e., change to post-test) = MED2 - MED1}$
- $\text{EDMar (i.e., change to follow-up) = MED3 - MED1}$

- $\text{EDDec (i.e., change to post-test) will correlate significantly with Participation}$
- $\text{EDMar (i.e., change to follow-up) will correlate significantly with Participation}$

**Research Question 4a**

It is hypothesized that treatment participants will self-report experiencing intersubjectivity during the peer pressure, academic expectations, and both cognitive development intervention discussion sessions. Mean intersubjectivity scores across all four sessions will be computed for each treatment participant. Cognitive intersubjectivity scores across both cognitive development intervention sessions will be computed for each
treatment participant as follows (scores of 0 and above will indicate that a positive degree of intersubjectivity is experienced):

\[
\text{ISJYMEAN} = \text{mean} (\text{ISJY5, ISJY6, ISJY7}).
\]

It is also hypothesized that higher degrees of intersubjectivity will be experienced during the cognitive development intervention sessions. (The variable name PERI in the following equations represents the cognitive development intervention sessions.) Mean difference scores will be used to assess if treatment participants self-report experiencing more intersubjectivity during the cognitive development intervention sessions than during the peer pressure and academic expectations sessions. Positive scores will indicate that a significantly higher degree of intersubjectivity is experienced during the cognitive development intervention sessions. Descriptive statistics will be used to test if there are, on average, significantly higher degrees of intersubjectivity during the cognitive development intervention sessions.

\[
\text{ISJYPERI} = \text{mean of} \ (\text{ISJY6, ISJY7})
\]

\[
\text{ISJYPPAE} = \text{mean of} \ (\text{ISJY4, ISJY5})
\]

\[
\text{LYDIFF} = \text{ISJYPERI} - \text{ISJYPPAE}
\]

*Research Question 4b*

It is hypothesized that greater levels of self-reported intersubjectivity will be associated with higher rates of program participation. Associations between rates of program participation and self-reported intersubjectivity will be assessed using correlations.

*Research Question 4c*
Post-test analysis. It is hypothesized that change in epistemological reflection by post-test will be moderated by intersubjectivity. First, simple regressions will test for three paths to the outcome variable of post-test epistemological reflection (pre-test epistemological reflection as a predictor, intersubjectivity as the moderator, and the product of pre-test and intersubjectivity as the interaction term). These equations are as follows:

\[ MED2 = a + b_1(MED1) + e \]
\[ MED2 = a + b_1(MED1) + b_2(ISJYM) + e \]
\[ MED2 = a + b_1(MED1) + b_2(ISJYM) + b_3(MER1ISJY) + e \]

In order to test if a predictive relationship between pre-test epistemological reflection and post-test epistemological reflection differs as a function of intersubjectivity, hierarchical multiple regression will be conducted. Post-test epistemological reflection will be regressed on pre-test epistemological reflection, intersubjectivity, and a pretest-intersubjectivity interaction term. Moderator effects will be indicated by a significant \( R^2 \) change for the interaction term, while pre-test epistemological reflection and intersubjectivity are controlled (Baron & Kenny, 1986). There may also be significant main effects for pre-test epistemological reflection and intersubjectivity. In order to better test for interactions, all predictors will be centered (Baron & Kenny, 1986). The equation tested is as follows:

\[ MED2 = a + b_1(MED1) + b_2(ISJYM) + b_3(MER1ISJY) + e \]

Follow-up analysis. It is also hypothesized that this pattern of results will be reported again at follow-up. That is, the relationship between pre-test scores and follow-
up scores of epistemological reflection will be moderated by intersubjectivity. This hypothesis will be tested with the following equation:

\[
\text{MED}_3 = a + b_1(\text{MED}_1) + e
\]

\[
\text{MED}_3 = a + b_1(\text{MED}_1) + b_2(\text{ISJY}\text{MEAN}) + e
\]

\[
\text{MED}_3 = a + b_1(\text{MED}_1) + b_2(\text{ISJY}\text{MEAN}) + b_3(\text{MED}_1\text{ISJY}) + e
\]

Similar to the previous hypothesis, hierarchical multiple regression will be conducted with the following equation:

\[
\text{MED}_3 = a + b_1(\text{MED}_1) + b_2(\text{ISJY}\text{MEAN}) + b_3(\text{MED}_1\text{ISJY}) + e
\]

Research Question 5a

It is hypothesized that change in epistemological reflection will be moderated either by intersubjectivity or metacognitive awareness or both. For this exploratory research question, it is hypothesized that change in epistemological reflection will be moderated by metacognitive awareness. Results from the following analyses will be compared with results of the analyses for research question 4c to determine if the effects of metacognitive awareness are similar to or different from those of intersubjectivity.

Post-test analysis. First, simple regressions will test for three paths to the outcome variable of post-test epistemological reflection (pre-test epistemological reflection as a predictor, metacognitive awareness as the moderator, and the product of pre-test and metacognitive awareness as the interaction term). These equations are as follows:

\[
\text{MED}_2 = a + b_1(\text{MED}_1) + e
\]

\[
\text{MED}_2 = a + b_1(\text{MED}_1) + b_2(\text{META}) + e
\]
Hierarchical multiple regression will be used to test if the predictive relationship between pre-test epistemological reflection and post-test epistemological reflection will be higher as a function of metacognitive awareness. Post-test epistemological reflection will be regressed on pre-test epistemological reflection, metacognitive awareness, and the pretest-metacognitive awareness interaction term. Moderator effects will be indicated if the interaction term has a significant effect above and beyond the effects of pre-test epistemological reflection and metacognitive awareness (Baron & Kenny, 1986). There may also be significant main effects for pre-test epistemological reflection and metacognitive awareness. In order to better test for interactions, all predictors will be centered (Baron & Kenny, 1986). The regression equation tested is as follows:

$$\text{MED2} = a + b_1(\text{MED1}) + b_2(\text{META}) + b_3(\text{MED1META}) + e$$

**Follow-up analysis.** This interaction effect is also hypothesized to be found at follow-up. Similar to the previous hypothesis, simple regressions will test for three paths to the outcome variable, as follows:

$$\text{MED3} = a + b_1(\text{MED1}) + e$$

$$\text{MED3} = a + b_1(\text{MED1}) + b_2(\text{META}) + e$$

$$\text{MED3} = a + b_1(\text{MED1}) + b_2(\text{META}) + b_3(\text{MED1META}) + e$$

Similar to the previous hypothesis, in order to test if a predictive relationship between pre-test epistemological reflection and follow-up epistemological reflection will differ as a function of metacognitive awareness, hierarchical multiple regression will be conducted. In order to better test for interactions, all predictors will be centered (Baron
& Kenny, 1986) for this equation as well, as follows:

\[ MED3 = a + b_1(MED1) + b_2(META) + b_3(MED1META) + e \]

**Research Question 5b**

It is hypothesized that change in epistemological reflection will be differentially moderated by metacognitive awareness for treatment and control participants. A three-way interaction will be used to assess if epistemological development is differentially moderated by metacognitive awareness by treatment condition.

**Post-test analysis.** First, simple regressions will test for seven paths to the outcome variable of post-test epistemological reflection (pre-test epistemological reflection as a predictor, condition as moderator, metacognitive awareness as a moderator, the product of pre-test epistemological reflection and condition as an interaction term, the product of pre-test epistemological reflection and metacognitive awareness as an interaction term, the product of condition and metacognitive awareness as an interaction term, and the product of pre-test, condition, and metacognitive awareness as an interaction term). The seven equations are as follows:

\[ MED2 = a + b_1(MED1) + e \]

\[ MED2 = a + b_1(MED1) + b_2(COND) + e \]

\[ MED2 = a + b_1(MED1) + b_2(COND) + b_3(META) + e \]

\[ MED2 = a + b_1(MED1) + b_2(COND) + b_3(META) + b_4(MED1COND) + e \]

\[ MED2 = a + b_1(MED1) + b_2(COND) + b_3(META) + b_4(MED1COND) + b_5(MED1META) + e \]

\[ MED2 = a + b_1(MED1) + b_2(COND) + b_3(META) + b_4(MED1COND) + b_5(MED1META) + e \]
Next, in order to test if a predictive relationship between pre-test epistemological reflection and post-test epistemological reflection will be higher as a function of metacognitive awareness and condition, hierarchical multiple regression will be conducted. Post-test epistemological reflection will be regressed on pre-test epistemological reflection and the six other predictors. Moderator effects will be indicated by a significant effect of the pretest-condition-metacognition interaction term while the effects of the other predictors are controlled (Baron & Kenny, 1986). The equation tested is as follows:

\[ MED2 = a + b_1(MED1) + b_2(COND) + b_3(META) + b_4(MED1COND) + b_5(MED1META) + b_6(CONDMETA) + b_7(M1CDMA) + e \]

Follow-up analysis. Similar to the previous hypothesis, in order to test if a predictive relationship between pre-test epistemological reflection and follow-up epistemological reflection will differ as a function of metacognitive awareness, simple and hierarchical multiple regressions will be conducted with follow-up post-test epistemological reflection as the dependent variable.
CHAPTER IV

RESULTS

This chapter is organized into six sections. First, the sample size and a power analysis is discussed. Second, a description is provided for attrition rates, epistemological reflection at all three time points, and each of the predictor variables. The third section discusses intercorrelations among the variables. Results from each of the research questions are described in the fourth section, followed by a fifth section that describes the results of supplementary post hoc regression tests, ANOVAs, and exploratory investigation of patterns of change. Finally, an evaluation of program process describes how events in the cognitive development intervention sessions are related to the statistical findings.

Power Analysis

A power analysis was conducted using McGee's (1990) Probability, Power, and Sample Size software. Setting the alpha level at .05, the power at .80, and the tests as two-tailed, a 2-to-1 treatment-to-control ratio was entered with treatment and control group means and standard deviations for pre-test epistemological reflection. Results indicated that a sample size of 100 (67 treatment; 33 control) would be required to find meaningfully significant results for large effects. Given that the sample for this study was only 83 (50 treatment; 33 control), a more liberal alpha ($p < .10$) was needed and subsequently used to interpret the results.

Sample Attrition

Based on previous research (Pratt et al., 2000) and the execution of the 2002-2003
pilot study, attrition through March was expected to be approximately 20 percent. Suprisingly, attrition in this study was remarkably low (11%).

Overall, attendance at the group discussion sessions was high. Forty-nine of the 50 treatment participants attended five discussion sessions or more and almost half attended all eight sessions ($N=23$). Eighty-eight percent of 392 sessions were attended, not including the 12 sessions that were missed by two students who had particularly low attendance. When these two outliers' sessions are included, 86% of the 408 sessions were attended. All treatment participants attended the December questionnaire-completion session, while 29 (96%) of the control participants attended the December questionnaire administration. In March, 47 (94%) of the treatment participants and 27 (82%) of the control participants completed the follow-up questionnaires. In sum, complete data was obtained from 75 participants, or 89% of the sample.

Two of the treatment cases merit special attention because of their low participation. Closer examination revealed that one participant chose not to attend any of the discussion sessions because of a previous interpersonal conflict with another member of the discussion group to which she was assigned. This participant was moved into the control group because she ostensibly did not undergo any of the intervention experiences. All results include this case as a control participant. The other case attended the first, third, and last session, the cognitive developmental intervention session about the construction of the pyramids, and the December questionnaire-completion session. Between semesters, this participant withdrew from the university (the reason is not known). Due to practical limitations with the sample size, this participant was not
dropped from subsequent analyses. Instead, pre-test and post-test results include this second case as a treatment participant.

**Description of the Variables**

**Pre-test epistemological reflection.** Table 4 presents descriptive statistics for pre-test epistemological reflection for the whole sample. On average, the participants scored 3.07 \( (SD = .29; \text{Min} = 2.33; \text{Max} = 4.47) \) during the summer before their first year at the university. This level of functioning is common in high school seniors who are about to enter college (Davison et al., 1990). While the lowest two scores were more than two standard deviations below the mean (2.33 and 2.53, respectively), more than one-third of the sample \( (N = 29) \) was functioning in Perry’s position 2, and a majority of the remainder of the sample \( (N = 53) \) was functioning in position 3. Only one student was functioning in Perry’s position 4. See Table 5 for the sample’s pre-test epistemological reflection frequency distribution. As a reminder, in position 2, truth is viewed to be absolute, as two divergent points of view are held. Views that contradict one’s point of view are deemed simply to be wrong. That is, different perspectives are distinguished in polar right-wrong/good-bad terms. Position 3 reflects the first acknowledgment and acceptance that uncertainty is a legitimate but temporary form of truth. In position 4, temporary uncertainty becomes subsumed in a new certainty that “we will never know anything for sure.”

Separate frequency distributions of the treatment and control group pre-test epistemological reflection scores can be found in Tables 6 and 7, respectively. The modal range of pre-test scores for the treatment group was 3.00 to 3.32 \( (N = 27) \), while
the modal range of scores for the control group was 2.67 to 2.99 \((N = 15)\). The two lowest pre-test scores appeared in the treatment group (i.e., these scores were in the 2.33 to 2.66 range).

**Post-test epistemological reflection.** Toward the end of the Fall semester, the average post-test epistemological reflection score for the whole sample was \(3.06 (SD = .20; \text{Min} = 2.47; \text{Max} = 3.53)\) (see Table 4). Scores ranged from 2.47 to 3.53, with 29% \((N = 23)\) of the sample functioning in Perry's position 2, and 71% \((N = 57)\) functioning in position 3. The range of epistemological reflection scores decreased from pre-test to post-test (see Table 5). For the treatment and control groups, the modal range of post-test scores was 3.00 to 3.32. Both groups scored within the same overall range. Frequency distributions of the treatment and control groups appear on Tables 6 and 7.

**Follow-up epistemological reflection.** Table 4 presents descriptive statistics for follow-up epistemological reflection for the whole sample. On average, the participants scored 3.11 \((SD = .26; \text{Min} = 2.34; \text{Max} = 3.80)\) during the middle of their second semester of college. The sample's frequency distribution of follow-up epistemological reflection appears on Table 5. One-fifth of the sample \((N = 16)\) was functioning in Perry's position 2 and the remainder of the sample \((N = 58)\) was functioning in position 3. No one was functioning in Perry's position 4. Separate frequency distributions of the treatment and control group follow-up scores can be found on Tables 6 and 7, respectively. Both groups' modal scores were within the 3.00 to 3.32 range, but the treatment group's second highest modal range was higher than the control group's. Twenty-three percent of the treatment group's follow-up scores were 3.33 to 3.66;
whereas, only 11% of the control group’s scores were within this range. The highest follow-up score appeared in the treatment group (i.e., in the 3.67 to 3.99 range).

*Metacognitive awareness.* The mean rating for metacognitive awareness for the whole sample was 6.57 on a scale of 1 to 10 (SD = 1.12; Min = 2.80; Max = 9.14) (see Table 4), which suggests that participants believed they engaged in sub-processes that facilitated the regulation of cognition such as planning, information management strategies, monitoring, debugging strategies, and evaluation. Almost 43% of the participants (N = 34) reported ratings between 6 and 7. More than 90% of the sample (N = 75) indicated relatively high levels of metacognitive awareness (i.e., ratings that averaged more than 5). The treatment group’s mean metacognitive awareness score was significantly higher than the control group’s score (t = -2.15, p < .05) (see Table 8).

*Program participation rates.* Descriptive statistics for program participation rates appear in Table 9. As noted above, participation rates were high. On average, treatment participants attended seven of the eight discussion sessions (SD = 1). Forty-nine (98%) of the treatment participants attended five discussion sessions or more, 44 (88%) attended six or more, 35 (70%) attended seven or more, and 23 (46%) attended all eight sessions.

*Intersubjectivity.* Participants reported moderately high levels of exposure to others’ reasoning during the discussions on peer pressure (M = 7.78; SD = 1.59), academic expectations (M = 7.54; SD = 1.81), the effects of chemical additives on foods (M = 7.71; SD = 1.98), and the construction of the pyramids (M = 8.18; SD = 1.91) sessions. Participants reported similar levels of an ability to adopt others’ reasoning during the peer pressure (M = 7.61; SD = 1.88), academic expectations (M = 7.61; SD =
1.48), chemical additives ($M = 7.93; SD = 1.67$), and pyramids ($M = 8.29; SD = 1.43$) sessions (see Table 10). The highest levels of these dimensions of intersubjectivity were reported during both of the cognitive development intervention sessions ($M = 2.22; SD = 1.49$ and $M = 1.11; SD = 1.90$, respectively), while the lowest levels were reported in the peer pressure session ($M = .17; SD = 1.57$). In addition, intersubjectivity did occur, on average, for participants during the cognitive development intervention sessions as well as the session on academic expectations ($M = .07; SD = 1.39$). In sum, although not significantly different, there was greater intersubjectivity, on average, for the cognitive development intervention sessions together ($M = 2.22; SD = 1.43$) than for all four sessions combined ($M = .13; SD = .88$).

**Intersubjective milieu.** Descriptions of intersubjective milieu can be found on Table 9. On average, treatment participants reported a moderately high degree to which the conversational conditions of the discussion sessions promoted intersubjectivity ($M = 7.69; SD = .96$). Twenty-nine students (58%) reported mean intersubjective condition ratings that ranged between 6 and 7 on a scale from 1 to 10, and 20 students (40%) endorsed mean ratings that ranged between 8 and 9. The condition that was reported as least present, on average, was a balance in disagreement (i.e., "the extent to which there was a balance in disagreement during the session") ($M = 6.42; SD = 1.60$). However, participants reported that they felt as though they were quite open and willing to disagree during the conversations ($M = 8.51; SD = 1.15$) (see Table 11). A paired-samples t-test demonstrated that the difference in the degree to which balance in disagreement and willingness to disagree were present was statistically significant ($t = -8.72, p < .001$).
Interrelations

Pre-test and post-test epistemological reflection. Correlations between pre-test and post-test epistemological reflection and other variables for both treatment and control groups appear on Table 1. Pre-test and post-test epistemological reflection scores were significantly positively correlated for both treatment \((r = .51, p < .001)\) and control groups \((r = .49, p < .001)\); however, higher pre-test scores were significantly related to lower rates of change in epistemological reflection by post-test for both groups \((r = -.66, p < .001\) and \(r = -.79, p < .001\), respectively). In the treatment group, neither post-test epistemological reflection nor change in epistemological reflection were associated with program participation rates, intersubjective milieu, or metacognitive awareness. In the control group, no relationship was found between post-test epistemological reflection and metacognitive awareness or between change in epistemological reflection and metacognitive awareness.

Follow-up epistemological reflection. Correlations between follow-up epistemological reflection and other variables also appear on Table 12. Follow-up epistemological reflection was significantly positively related to pre-test and post-test epistemological reflection at the bivariate level for both treatment \((r = .78, p < .001)\) and control groups \((r = .55, p < .01)\). However, higher pre-test scores were significantly related to lower rates of change by follow-up for the treatment group \((r = -.41, p < .01)\) and the control group \((r = -.40, p < .05)\). In the treatment group, neither follow-up epistemological reflection nor change in epistemological reflection between pre-test and follow-up were associated with program participation rates, intersubjective milieu, or
metacognitive awareness. In the control group, a significant negative relationship was found between change in epistemological reflection between pre-test and follow-up and metacognitive awareness ($r = -0.34, p < 0.10$). For both groups, change from pre-test to post-test was correlated with change from pre-test to follow-up ($r = 0.60, p < 0.001; r = 0.44, p < 0.05$) and follow-up was correlated with change to follow-up ($r = 0.24, p < 0.10; r = 0.66, p < 0.001$).

_Treatment variables._ Intercorrelations among treatment variables can be found on Table 13. Intersubjective milieu was significantly positively related to exposure to others’ reasoning and adoption of others’ reasoning in both of the cognitive development intervention sessions ($r = 0.47, p < 0.001; r = 0.56, p < 0.001; r = 0.39, p < 0.01; r = 0.47, p < 0.01$). No relationships were found between intersubjective milieu and intersubjectivity either across the two cognitive sessions (i.e., the chemical additives and pyramids sessions) or the four sessions in which intersubjectivity was measured. Program participation rates were not related to intersubjective milieu or any of the other treatment variables (see Table 13).

_Intersubjectivity variables._ Exposure to reasoning was significantly associated across both of the cognitive development intervention sessions ($r = 0.59, p < 0.001$). Adoption to reasoning was also significantly related across both cognitive sessions ($r = 0.37, p < 0.05$). Exposure was significantly related to both adoption and intersubjectivity in expected directions within the chemical additives session ($r = 0.68, p < 0.001; r = -0.57, p < 0.001$, respectively) and within the construction of the pyramids session ($r = 0.38, p < 0.05; r = -0.72, p < 0.001$, respectively). Adoption was significantly related to both exposure and
intersubjectivity in the expected direction only within the pyramids session \((r = .48, p < .01; r = .37, p < .05)\). Exposure during the chemical additives session was associated with adoption during the pyramids session \((r = .31, p < .10)\). Overall, intersubjectivity during the cognitive sessions was moderately to highly negatively correlated with exposure \((r = -.51, p < .001\) and \(r = -.68, p < .001\), respectively) and positively correlated with session-specific intersubjectivity \((r = .81, p < .001\) and \(r = .87, p < .001\), respectively) in each of these sessions (see Table 13).

*Mean intersubjectivity.* Mean intersubjectivity across all four sessions in which it was measured was significantly associated with seven of the nine other important treatment variables (see Table 13). More specifically, mean intersubjectivity was positively associated with intersubjectivity during the cognitive sessions \((r = .53, p < .001)\) and with all session-specific measures of intersubjectivity \((r = .47, p < .001; r = .68, p < .001; r = .48, p < .001; r = .61, p < .001)\), and negatively associated with exposure during the cognitive sessions \((r = -.45, p < .01; r = -.48, p < .01)\). In light of this preponderance of significant intercorrelations, mean intersubjectivity rather than cognitive intersubjectivity was used as a predictor in all subsequent analyses.

*Domains within the Measure of Epistemological Development.* Intercorrelations between the five pre-test epistemological reflection domains and the same post-test domains appear in Table 14. Pre-test assessment of the *role of the learner* domain was significantly associated with all post-test domains except the *role of evaluation* domain. Pre-test measurement of the *role of the instructor* domain was related to all post-test domains except the *nature of knowledge* domain. The pre-test *role of peers* domain was
only significantly correlated with the post-test role of the learner domain ($r = .29, p < .01$). The pre-test role of evaluation domain scores were associated only with the post-test role of peers ($r = .37, p < .001$) and role of evaluation domains ($r = .30, p < .01$). Pre-test scores on the nature of knowledge domain were related to all post-test domains except the role of evaluation domain.

Table 15 shows intercorrelations between the pre-test and follow-up domains. Pre-test assessment of the role of the learner domain was significantly associated with all follow-up domains except the nature of knowledge domain. Pre-test measurement of the role of the instructor domain was related to every follow-up domain. The pre-test role of peers domain was only correlated with follow-up role of the instructor ($r = .31, p < .01$) and role of peers ($r = .31, p < .01$) domains. The pre-test role of evaluation domain scores were associated with every follow-up domain. Pre-test scores on the nature of knowledge domain were related to all follow-up domains except the nature of knowledge domain.

The intercorrelations between the five post-test and five follow-up epistemological reflection domains appear in Table 16. Post-test assessment of the role of the learner domain was significantly associated with all follow-up domains except the nature of knowledge domain. Post-test measurement of the role of the instructor domain was also related to all follow-up domains except the nature of knowledge domain. Similarly, the post-test role of peers domain was correlated with all follow-up domains except the nature of knowledge domain. The post-test role of evaluation domain scores were associated with follow-up role of the learner ($r = .27, p < .05$), role of the instructor ($r = .29, p < .01$), role of peers ($r = .37, p < .001$), and role of evaluation ($r = .30, p < .01$) domains.
.24, \( p < .05 \), and role of evaluation \( (r = .39, p < .001) \) domains. Post-test scores on the nature of knowledge domain were related to role of evaluation \( (r = .27, p < .05) \), and nature of knowledge \( (r = .28, p < .05) \) domains.

**Research Questions**

**Research Question 1 Results**

Results from a paired-sample t-test did not support the hypothesis that epistemological reflection would develop significantly between pre-test and post-test. That is, MED scores would did not increase more than .10 of a stage between pre-test and post-test. Descriptive statistics indicate that, on average, no significant change occurred during this time period for this sample (see Table 4). Instead, the mean change was -.0098 (SD = .26). Twenty-nine (36.5%) of the participants’ post-test scores changed less than .10 of a stage (in either direction), and ten (12.5%) of the participants’ level of functioning remained exactly the same.

The prediction that epistemological reflection would develop significantly between pre-test and follow-up was confirmed by a paired-sample t-test \( (t = -2.60, p < .01) \). That is, MED scores increased more than .10 of a stage between pre-test and follow-up. Descriptive statistics indicate that, on average, change occurred during this time period for this sample (see Table 4). The mean change was .06 (SD = .21). While 10 (12.5%) of the participants’ level of functioning remained exactly the same and 29 (36.5%) of the participants’ follow-up scores changed less than one-tenth of a stage (in either direction), 33 (45%) of the participants grew more than one-tenth of a stage.
Research Question 2 Results

Post-test results. There was no support for the hypothesis that epistemological reflection would develop significantly more among treatment participants than control participants. The first half of this hypothesis predicted that treatment participants would develop significantly more than control participants between pre-test and post-test. A t-test was performed using each group's change score as the dependent variable. A post hoc univariate ANOVA with pre-test entered as a covariate also indicated that the groups' post-test scores did not differ significantly from each other.

Follow-up results. Confirmation for the second half of this hypothesis was obtained using a 2 (condition; control, treatment) x 3 (time: pre-test epistemological reflection, post-test epistemological reflection, follow-up epistemological reflection) repeated measures MANOVA. Specifically, it was hypothesized that treatment participants would develop significantly more than control participants by follow-up. This analysis tested the difference between treatment and control group means at all three time points. Results confirm that a significant difference from post-test to follow-up was found. Specifically, while the control group changed little from pre-test to post-test or from post-test to follow-up (i.e., the group change .02 at each interval), the treatment group was stable from pre-test to post-test (-.004), then developed between post-test and follow-up (.09) \( [F(2, 72) = 7.06, p < .01] \). Figure 1 represents these group trajectories.

Research Question 3 Results

Correlational analyses revealed no significant associations to support research question 3, which predicted that higher rates of epistemological development at post-test
and at follow-up in treatment participants would be associated with significantly higher rates of program participation (see Table 12).

Research Question 4a Results

In this two-part question, it was hypothesized that treatment participants would experience intersubjectivity during the four sessions in which it was measured, with positive mean scores indicating the presence of intersubjectivity during each session and negative mean scores reflecting its absence. Table 10 shows descriptive statistics for intersubjectivity in the peer pressure, academic expectations, chemical additives, and pyramids discussion sessions. Descriptive statistics indicated that intersubjectivity was not experienced during the peer pressure session, but it was experienced in the other three sessions (peer pressure $M = -.17, SD = 1.57$; academic expectations $M = .07, SD = 1.39$; chemical additives $M = .22, SD = 1.49$; construction of the pyramids $M = .11, SD = 1.90$).

Results did not support the hypotheses that significantly higher degrees of intersubjectivity would be experienced during the cognitive development intervention sessions than the non-cognitive sessions or than all four sessions combined. Although, positive mean difference scores did indicate more intersubjectivity during the cognitive sessions ($M = .22, SD = 1.43$) than the non-cognitive sessions ($M = .02; SD = 1.38$) and participants did report experiencing more intersubjectivity during the cognitive sessions than all four sessions overall ($M = .13, SD = .88$).

Research Question 4b Results

Table 13 presents the intercorrelations of treatment participants' program participation rates and intersubjectivity scores. Although it was hypothesized that
intersubjectivity would be significantly associated with program participation, the only intersubjectivity item that was related to participation rate was intersubjectivity during the academic expectations discussion.

Research Question 4c Results

Post-test results. There was no support for the hypothesis that the relationship between pre-test and post-test epistemological reflection would be moderated by mean intersubjectivity. Multiple regression was used to test if the relationship between pre-test and post-test epistemological reflection was moderated by mean intersubjectivity. Prior to running the multiple regression model, a data transformation was made because pre-test epistemological reflection was positively skewed (1.30, SE = .04). A square root transformation reduced the skewness of the distribution to .01. As suggested by Aiken and West (1991), all predictors that were used to create interaction terms in all of the multiple regression analyses for this study were centered to reduce non-essential multicollinearity and thus allow for a more fair test of interaction effects. Table 17 contains both the standardized and unstandardized beta coefficients for the regression model utilizing mean intersubjectivity as a predictor of post-test epistemological reflection. In Step 1, variance in post-test epistemological reflection could be predicted by pre-test epistemological reflection ($R^2 = .27, p < .001$). In Step 2, mean intersubjectivity was not significant and in Step 3, an interaction term consisting of the product of the centered pre-test epistemological reflection and the centered mean intersubjectivity terms was entered, but was not found to be significant.

Follow-up results. Table 18 also contains the standardized and unstandardized
beta coefficients for the regression model utilizing mean intersubjectivity as a predictor of follow-up epistemological reflection. This multiple regression analysis tested if the relationship between pre-test epistemological reflection and follow-up epistemological reflection was moderated by mean intersubjectivity. In Step 1, pre-test epistemological reflection was entered. Results indicated that variance in follow-up epistemological reflection could be predicted by pre-test epistemological reflection ($R^2 = .61$, $p < .001$). In Step 2, mean intersubjectivity was added as a predictor, but it was not found to be significant. In Step 3, an interaction term consisting of the product of the centered pre-test epistemological reflection and the centered mean intersubjectivity terms was entered and it was found to be significant ($\beta = -.19$, $p < .05$), with 64% of the variance in follow-up epistemological reflection accounted for by this third model. Figure 2 illustrates this significant interaction.

For this hypothesis, an interaction between pre-test epistemological reflection and mean intersubjectivity successfully predicted follow-up epistemological reflection. That is, a significant positive bivariate relationship between pre-test and follow-up was found, and this relationship was moderated by intersubjectivity, such that participants who report higher levels of intersubjectivity are predicted to have lower follow-up scores than participants who report lower levels of intersubjectivity.

Research Question 5a Results

Multiple regressions testing whether the relationships between pre-test and post-test epistemological reflection as well as pre-test and follow-up epistemological reflection would be moderated by metacognitive awareness were not significant.
Prior to running this multiple regression model, a data transformation was attempted on metacognitive awareness. However, the square transformation increased the skewness from -.43 to 1.61 (i.e., it became more skewed than before the transformation). Therefore, the untransformed variable was used in subsequent multiple regression analyses. Table 19 contains both the standardized and unstandardized beta coefficients for the regression model utilizing metacognitive awareness as a predictor of post-test epistemological reflection. Table 20 contains the regression model utilizing metacognitive awareness as a predictor of follow-up epistemological reflection.

Research Question 5b Results

A significant multiple regression analysis demonstrated that change in epistemological reflection by follow-up (but not by post-test) was moderated by metacognitive awareness for treatment and control participants.

The non-significant post-test analysis appears in Table 21, which contains both the standardized and unstandardized beta coefficients for the regression model utilizing condition and metacognitive awareness as predictors of post-test epistemological reflection.

The multiple regression model testing whether change in epistemological reflection was moderated by metacognitive awareness differentially for treatment and for control participants by follow-up appears in Table 22. The seven-step model significantly accounted for 53% of the variance in follow-up epistemological reflection. In Step 1, pre-test epistemological reflection was entered. Results indicated that variance in follow-up epistemological reflection could be predicted by pre-test epistemological
reflection ($R^2 = .48, p < .001$). In Step 2, condition was added as a predictor, but it was not significant. In Step 3, metacognitive awareness was added and was found to be significant ($\beta = -41, p < .10$). The addition, in Step 4 of an interaction term consisting of the product of centered pre-test epistemological reflection and condition was not significant. In Step 5, the pre-test epistemological reflection and metacognitive awareness interaction term was entered, but was not found to be significant.

In Step 6, the interaction term consisting of the product of condition and centered metacognitive awareness was entered and it was found to be significant ($\beta = .44, p < .05$). Through the addition of this interaction term, statistical suppression was discovered. That is, the condition by metacognitive awareness interaction term functioned as a suppressor in the multivariate equation including all seven predictors of follow-up epistemological reflection. Metacognitive awareness did not emerge as a significant predictor in previous steps, until the effects of the condition by metacognitive awareness interaction term were controlled. Further, the standardized coefficient for metacognitive awareness reversed in direction, becoming a negative predictor of follow-up epistemological reflection after the condition by metacognitive awareness interaction term was entered in the equation. Figure 3 illustrates this significant interaction.

Finally, in Step 7, the three-way interaction term (the product of centered pre-test epistemological reflection X condition X centered metacognitive awareness) was entered but found to be non-significant. Instead of confirming the three-way interaction hypothesis, Step 7 demonstrated that the lower-order two-way interaction found in Step 6 remained statistically significant (see Table 22). The unique effects of the metacognitive
awareness by condition interaction term and the suppressed metacognitive awareness variable remained in Step 7, after the effects of pre-test epistemological reflection, metacognitive awareness, and the three-way interaction term (pre-test X metacognitive awareness X condition) were controlled statistically.

*Post Hoc Tests to Uncover Patterns*

*Statistical Tests*

*Regression and ANOVA tests.* Supplementary multiple regressions and ANOVAs were pursued to further investigate possible relationships among the variables at post-test. When post-test epistemological reflection was regressed on each of the independent variables on one step in a multiple regression, none of the predictors were found to significantly explain variance in the dependent variable. Entering change in epistemological reflection or residual change scores as the dependent variables, instead of post-test epistemological reflection, also resulted in non-significant regression coefficients. Results from all of the preceding hierarchical multiple regressions, using uncentered rather than centered independent and dependent variables, and transformed variables when appropriate, did not reveal significant relationships, as would be expected. When demographic factors (i.e., gender, age, ethnicity, language spoken at home, high school GPA, major, high school location, year in college, and highest SAT verbal score) were added as control variables in regression equations, no significant results were found. In addition, an attempt was made to test for important group differences by converting all continuous predictors into categorical variables and using ANOVAs. Post-test epistemological reflection, change in epistemological reflection, and residual change
scores were each entered as dependent variables in these ANOVAs. No significant results were discovered.

*Intersubjective milieu and program participation.* It was considered, in chapter three, that intersubjective milieu may be used in lieu of or in combination with participation tallies in research questions 3 and 4b. In particular, more *active and enabled* participation could be associated with higher rates of change in epistemological reflection and with more intersubjective experiences during discussion sessions than mere attendance. However, no significant correlations were found between change scores at post-test and intersubjective milieu or between change scores at follow-up and intersubjective milieu (see Table 12), therefore, it was not reasonable to replace program participation with intersubjective milieu in research question 3. Also, when intersubjective milieu and program participation were combined into either multiplicative or additive variables, no significant correlations with epistemological development were found.

*Evaluation of Program Process*

Results indicated that there were higher levels of exposure to different reasoning, adoption of different reasoning, and session-specific intersubjectivity in both of the cognitive development intervention sessions than in the non-cognitive discussion sessions. In the following two sections, each of the cognitive development intervention discussions will be described to highlight elements of those conversations that may shed light on these findings.

*Evaluation of Effects of Chemical Additives on Foods Session*
In general, participants were very interested during the chemical additives discussion session. Some students offered knowledgeable comments about possible causes of cancer that they learned in classes, others provided concrete examples of harmful chemical reactions in foods (e.g., ingredients in diet sodas turn to formaldehyde at approximately 100 degrees), and some grasped the possibility that sources of funding could influence researchers' findings, thus leading experts who study the effects of chemical additives on foods to disagree.

More specifically, the description of the Kitchener and King's reflective judgment stages seemed to go well. Several participants resonated with explanations of the earlier stages (i.e., some students nodded, some laughed, some whispered to the person sitting next to them). Other participants asked questions to get clarification on the latter stages (e.g., "Is it possible to get all the way up to the seventh stage and then start over with the first stage on a 'new level' the next time around?" and "Do people use stage-six thinking on everything in their lives?").

When the discussion moved to each person stating and justifying the most complex reasoning structure they could use, two interesting patterns emerged. On the one hand, many of the participants claimed that they could easily apply the reasoning of stage six to the chemical additives dilemma. On the other hand, many participants appeared to have chosen to comply with others' self-evaluations (i.e., they suggested that they could apply the same stage others had already mentioned). When the former group was challenged, a majority lowered the stage rather than supporting their viewpoints with stage-six justifications. When the latter group was challenged to "base your comments
on the most complex way you can think” they appeared to experience dissonance between blending in with others (e.g., “Like she said . . .”) or stretching themselves to grasp a different, more complex reasoning structure.

The application of the stages to the chemical additives dilemma proved to be more difficult. Often participants needed to be reminded to anchor their comments about the dilemma in terms of the stages of reflective judgment. It is possible that the participants were operating on their functional levels and not finding it easy to generate more complex justifications for their thinking (i.e., justifications either that matched their own optimal level of functioning or that matched the high stage they originally claimed to understand). Additionally, some of the Kitchener and King probe questions used to guide the discussion were perceived to be redundant with others. When the nuances of the questions were highlighted, participants seemed to understand the differences and answer accordingly, but they often added comments that were personal observations about the dilemma rather than well-formulated stage-based justifications.

During this session, reaching agreement seemed to go relatively well. Although most of the groups engaged in a superficial and somewhat expeditious attempt to get it over with instead of engage in an intellectual struggle, generally they discussed the alternatives and reached consensus. Consistent with the results, conditions that facilitate the intersubjective process appeared to be present during the chemical additives discussion session (i.e., there was a peer discussion that focused on the topic at hand while different points of view, opinions, and arguments were offered). Furthermore, participants believed they were exposed to and able to adopt others’ explanations and
arguments for ideas. As noted in the previous chapter, although participants thought they felt quite open and willing to disagree with each other, they rated balance in disagreement as least present in the group discussion. As an explanation, perhaps individuals felt comfortable enough to disagree if they felt it was necessary, yet many of them did not actually openly offer controversial or contradictory comments for others to hear.

**Evaluation of Construction of the Pyramids Session**

For the most part, the discussion about the construction of the pyramids unfolded in the same way as the chemical additives discussion. Several differences between the sessions will be highlighted here. In general, participants were not as interested in the construction of the pyramids topic as they were in the chemical additives topic. They were quieter during this session and occasionally mentioned the ‘boring’ nature of the dilemma. Notwithstanding, some participants were already aware of existing theories about the pyramids (e.g., hieroglyphics suggest that aliens created the pyramids, water and rollers were used, many generations of Egyptians were involved in their construction over centuries). These competing theories were shared with other discussion groups by the principal investigator to increase participants’ interest levels. The preponderance of personal biases in the competing theories was noted by several participants as a possible reason why experts disagree about the construction of the pyramids.

By this second cognitive development intervention session, participants seemed to have formed opinions and made observations about the description of the Kitchener and King stages. The stages of reflective judgment became the topic of discussion. Some
questioned the validity of stages, others grew to appreciate the complexity of and intricate
differences between stages (e.g., “I just can’t handle the idea that uncertainty is necessary
because that would mean we don’t know anything and I think I’d go crazy if I assumed
we don’t know anything for sure at all. I’d go crazy.” and “I think it’s really not possible
to be a stage-six person in everything you do because then you’d have to be almost an
expert in everything you ever think about and that’s just not humanly possible.”).

When the discussion moved to each person stating and justifying the most
complex reasoning structure they could use, some of the participants found it useful to
employ the creation versus evolution dilemma to describe their thinking (e.g., “If you
think about it, we can never know for sure if heaven exists or the truthfulness of the
Bible. You can never verify faith.”). In the pyramids session, many more participants
considered the sixth stage to be beyond their grasp, while a few appeared emboldened by
their ability to at least comprehend the stage (“Sure, I think I could say I’m thinking at
stage six because I can compare information from all the sources we are talking about
and choose the theory I think is better than the rest. I would research it on my own if I
had the time, I just don’t have the time right now, so I can’t.”).

As in the chemical additives session, participants needed to be reminded to anchor
their comments about the dilemma in terms of the stages of reflective judgment, but
during the construction of the pyramids session they were better able (or possibly more
interested) to have a conversation about the stages themselves than about the construction
of the pyramids topic. The shift in focus toward an active discussion of the stages could
be an explanation for the finding that adoption of others’ reasoning was significantly
positively related to exposure to others’ reasoning as well as the highest session-specific intersubjectivity ratings in the pyramids session. Furthermore, the significant association between exposure to others’ reasoning in the chemical additives session and adoption of others’ reasoning in the pyramids session could be confirmation that scaffolding did occur. Perhaps the guided exposure to more complex reasoning structures in the first cognitive session and the guided agreement-reaching exercise in the first cognitive session provided scaffolding which enabled the participants to more-readily adopt others’ forms of thought about the stages in the second cognitive session.

In this second cognitive development intervention session, reaching agreement was comparatively more superficial than in the first session. The groups discussed the alternatives and reached consensus more quickly. Nevertheless, conditions that facilitate the intersubjective process appeared to be present and, as reported in the previous chapter, participants believed they were exposed to and able to adopt others’ explanations and arguments for ideas.

When asked, most participants admitted that they did not practice with others between sessions. Those who did, mentioned that it was far more difficult to describe the stages and the dilemma than they thought it would be. Participants’ roommates could not understand the complexities, became confused, which confused the participants, hence the conversations ended shortly after they began. Nevertheless, all discussions groups were strongly encouraged to attempt to discuss the stages and the dilemmas with peers outside of the group to practice using the reasoning structures.
CHAPTER V

DISCUSSION

The present study examined the cognitive development of first-year college students. In particular, the study explored mechanisms that are believed to promote epistemological development by employing the under-utilized quasi-experimental design in a peer group discussion intervention program. This final chapter discusses the results of the study, their contribution to our understanding of the cognitive developmental process, and their implications for future research and intervention. The chapter is organized into eight specific sections. First, the most noteworthy findings and their theoretical background are introduced. Results from each research question are discussed next. Then, some theoretical contributions, methodological contributions, and intervention applications are presented. Potential competing and explanatory hypotheses, limitations, and directions for future research are suggested at the conclusion.

Rationale and Organization

Before turning to this discussion, however, a brief review of the rationale and an overview of the organization of the study will be presented. The study aimed to accomplish two main goals: to explore if cognitive developmental change in epistemological reflection occurred among first-year college students during their transition into a large research university and to untangle the process of that development by investigating the role of two potential change mechanisms.

The first mechanism, intersubjectivity, is a theoretical cognitive developmental process construct that has only been investigated empirically during childhood (Tudge,
The present study explored if the intersubjective process operates beyond formal operations into epistemological reflection among first-year college students. It attempted to explain the role of intersubjectivity in the epistemological developmental process by assessing, at two time points during students' first year in college, if intersubjectivity moderated change in epistemological reflection.

Second, the development of epistemological reflection may depend on participants' metacognitive awareness. Kitchener (1983) hypothesized that epistemic processes may operate in combination with metacognitive processes to account for the kind of monitoring individuals engage in when they consider and solve ill-structured problems. Development of epistemic cognition may depend on the metacognitive processes that are applied in solving ill-structured problems. Thus, this study attempted to clarify if metacognitive awareness moderated change in epistemological reflection and if its effects were demonstrated differentially between a treatment group that engaged in two guided ill-structured problem solving discussions and a control group.

The present study attempted to extend our understanding of the effectiveness of intersubjectivity and metacognitive awareness in promoting development along the Perry Scheme among a sample of under-represented first-year honors college students by utilizing the Prototypic Reflective Judgment Interview (PRJI) in a collegiate peer group-based cognitive development intervention format. Two sets of post-intervention analyses were conducted to disentangle the roles of these theoretical mechanisms of cognitive development to inform educational practice, theory, and future research on the cognitive developmental process.
Most Noteworthy Findings

The notable differences between the treatment and control groups. Statistically significant development in epistemological reflection occurred between pre-test (the summer before participants entered college) and follow-up (the middle of participants' second semester in college) in the sample as a whole, and in the treatment group in particular. Also, consistent with the theoretical threshold previously established by King and Kitchener (1994), the treatment group developed significantly during the second semester. That is, the treatment group grew one-tenth of a position between post-test ($M = 3.05, SD = 2.01$) and follow-up ($M = 3.15, SD = .25$). Although modest, this finding is encouraging, given that previous research suggests that students typically grow two-tenths of a stage during their first two years in college (Kitchener et al., 1989; Schmidt, 1985).

As noted in Chapter 2, previous research demonstrates that, on average, students develop through their first year of college (Schmidt, 1985; Welfel & Davison, 1986) and students who experience interventions that offer contextual support (i.e., scaffolding and practice) appear to develop more quickly than students who do not undergo similar interventions (Davison et al., 1990; Kitchener & King, 1981; Kitchener et al., 1989; Kitchener et al., 1993; Schmidt, 1985). Therefore, it was expected that all participants would grow steadily during both semesters and treatment participants would develop more than control participants. This study supports the interpretation that the scaffolding provided during intervention discussion sessions and the practice encouraged between these sessions contributed to the promotion of higher rates of development in the
treatment group. The present study methodologically controlled for the effects of scaffolding and practice in the treatment context. Only the treatment participants were provided scaffolding during discussions and encouraged to practice between the sessions. It should be noted that conclusions can only be drawn about the effects of scaffolding and practice on treatment participants’ functional levels of epistemological reflection, rather than their optimal levels of reasoning because the MED measured participants’ functional performance.

What is remarkable about the emergence of a significant difference between the treatment group and control group at follow-up is its occurrence three months after the treatment group’s slight regression in epistemological reflection. It is possible that treatment participants may have experienced Piagetian disequilibration (Crain, 2000) in the two weeks between the cognitive development intervention sessions and the post-test questionnaire-completion session. The treatment group evinced what neo-Piagetians accept as multi-directionality in movement (i.e., backwards movement or regression), assimilated and accommodated new reasoning structures, which eventuated three months later at follow-up in more hierarchically-complex reasoning (Berkowitz & Gibbs, 1983) or equilibration.

The notable role of intersubjectivity in epistemological development. As expected, treatment group participants reported that intersubjectivity was experienced during discussion sessions, and especially in the cognitive developmental intervention sessions. Furthermore, results from follow-up regression tests indicated that intersubjectivity did indeed moderate the relationship between pre-test and follow-up
epistemological reflection. Unexpectedly though, and contrary to hypothesis 4c, higher intersubjectivity scores were associated with lower rather than higher follow-up epistemological reflection scores. Most notably, treatment participants who reported the lowest intersubjectivity ratings scored higher on follow-up epistemological reflection than did treatment participants who reported higher intersubjectivity.

This fascinating finding may be demonstrating the neo-Piagetian concept of socio-cognitive conflict. That is, it is possible that participants in the treatment group who reported the highest levels of intersubjectivity experienced perturbations in their reasoning arising from interpersonal socio-cognitive conflict during the discussion sessions (Dimant & Bearison, 1991). A corresponding experience of disequilibrium could account for the overall slight regression in the treatment group and the pronounced delay in development found among treatment participants who reported the highest levels of intersubjectivity during the sessions. Conversely, treatment participants who reported the lowest levels of intersubjectivity may have scored highest on follow-up epistemological reflection because, as the computation of the intersubjectivity variable requires, they were exposed to new forms of reasoning, but they did not feel socio-cognitive conflict and disequilibrium during discussion sessions because they did not adopt others' reasoning. Therefore, they could have more comfortably developed reasoning based upon more hierarchically-complex epistemological structures at follow-up.

Similar to the suggestion above, the design of the present study methodologically controlled for the effects of intersubjectivity. Only the treatment participants experienced
discussions that were deliberately constructed to promote intersubjective conversations with peers. Therefore, it may be concluded that the significant difference between the treatment and control groups on follow-up epistemological reflection could be partially attributed to the role of intersubjectivity during the intervention sessions.

*The notable discovery of the role of metacognitive awareness.* At post-test, treatment participants scored significantly higher on metacognitive awareness than control participants. Interestingly, results from follow-up regression tests indicate that metacognitive awareness did not moderate the relationship between pre-test and follow-up epistemological reflection unless treatment condition was included in the model (i.e., follow-up epistemological reflection depended jointly upon metacognitive awareness and treatment condition). In other words, there was a negative association between follow-up epistemological reflection and metacognitive awareness, but this relationship was buffered for treatment participants. A negative relationship between metacognitive awareness and follow-up epistemological reflection in the control group, and a positive relationship between these variables in the treatment group suggests that the cognitive development intervention may have buffered the risk of regression for treatment participants. In essence, the treatment group appeared to stabilize more in epistemological complexity with increased metacognitive awareness, than the control group which regressed more, on average, from pre-test to follow-up.

These initial findings provide the first validation of Kitchener’s (1983) three-level model of cognitive processing, which proposed that epistemic cognition operates in combination with metacognitive processes to monitor progress in solving ill-structured
problems. During the cognitive development intervention sessions, treatment participants could have experienced metacognitive puzzlement that may have led to re-evaluation of cognitive strategies (King & Kitchener, 2002; Kitchener, 1983) and contributed to their relative epistemological progress. Perhaps control participants, who were not afforded opportunities to develop knowledge about ill-structured problem-solving tasks or to monitor their cognitive progress in solving similar complex problems, demonstrated more metacognitive puzzlement or greater regression in functioning in their follow-up epistemological reflection scores than treatment group participants.

Research Questions

Discussion of research question 1. As noted in Chapter 2, previous research has shown that high school seniors and first-year college students typically function between Perry’s second and fourth positions (i.e., between 2.28 and 4.07) (Davison et al., 1990; Kitchener et al., 1989; Kitchener & King, 1981). More specifically, first-year students are believed to hold viewpoints ranging approximately from a stable position 3 perspective to a dominant position 4 with trailing position 3 perspective (i.e., from 3.33 to 3.67) (Davison et al., 1990; Moore, 1990). Surprisingly, in comparison with these statistics and Davison and colleagues (1990) meta-analysis, all mean epistemological reflection scores in the present sample were lower than even the lowest estimates for high school seniors, which is 3.18. The sample appeared to have consistently under-performed in epistemological reflection during the first year of college. Furthermore, no change was witnessed between pre-test and post-test. Instead, participants regressed one-hundredth of a position during their first semester. Fortunately, significant
epistemological development was witnessed by follow-up in the treatment group. Forty-five percent of the sample ($N = 33$) grew more than one-tenth of a stage between pre-test and follow-up. However, results failed to confirm the hypothesis that a majority of the participants would develop to higher Perry positions by follow-up.

*Discussion of research question 2.* As planned, analyses moved toward an examination of whether more epistemological development could be found among treatment participants at post-test and at follow-up. Since no change was found during participants' first semester, analyses failed to confirm the hypothesis that treatment-control group differences existed by post-test. Also, no differences in rates of change were revealed at post-test, even when pre-test epistemological reflection score was accounted for as a covariate in the model.

One explanation for the absence of change from pre-test to post-test, regardless of treatment group membership, readily presents itself. Participants in this study were driven high school students in accelerated academic programs who became anonymous numbers in large general education courses during their first semester of college. Ostensibly, these students' high school academic programs and instructors fostered engaged discussion, involvement with course material, and active critical thinking. However, further development in epistemological reflection through the first semester of college may have stalled. Many students noted in their MED responses that the demands of the lower-division college curriculum requires first-year students to enroll in extremely large, impersonal, and unengaging general education courses and to "memorize and regurgitate information" delivered to them in class and through assigned reading
materials. The students in this sample were simply not engaged in the processes of epistemological development in their courses. Rather, they noted that they had become excellent memorizers who listened to their professors deliver the information they needed to know to pass exams. In terms of the Perry Scheme, these comments are the hallmarks of early position-three reasoning (Perry, 1970, 1981). The lack of development and slight appearance of regression could be an indication that students in this sample were adapting to different academic demands. Indeed, they adapted quite well. Their mean grade point average after their first semester of college was 3.45 and 56.6% obtained a 3.5 or higher.

Follow-up results confirmed the hypothesis that the treatment group would develop more than the control group by the second semester. Treatment condition had a significant effect on follow-up epistemological reflection scores, such that the treatment group scored higher than the control group at pre-test, regressed slightly at post-test, then scored significantly higher than the control group at follow-up \[ F(2, 72) = 7.06, p < .01 \]. The control group developed at a consistent and gradual, yet non-significant rate from pre-test to follow-up. These findings offer evidence for the argument that due to participation in the intervention of this study, treatment participants were more engaged in the processes of epistemological development than control participants, which could partially explain the importance of peer discussions to the epistemological developmental process.

**Discussion of research question 3.** The hypothesis that program participation rates would be positively associated with higher rates of development was not confirmed.
It was considered, in Chapter 2, that program participation rates could be analyzed in conjunction with or in lieu of intersubjective milieu in this research question. Intersubjective milieu, if associated with program participation rates, might reflect a more active and enabled form of participation in the discussions. However, Chapter 3 describes the lack of significant associations between these two variables, rendering this analytic alternative impractical. As will be discussed below, this study may have overestimated the importance of program participation and underestimated the effects of intersubjectivity in the process of development.

Discussion of research question 4a. As expected, treatment participants did report experiencing intersubjectivity during the academic expectations, effects of chemical additives on foods, and construction of the pyramids discussion sessions. Additionally, there were reports of slightly more intersubjectivity in the cognitive sessions than the non-cognitive sessions and in the cognitive sessions than all four sessions combined. It should be noted that these findings were neither hypothesized to demonstrate significant differences nor found to do so.

This set of results confirms several theoretically-based empirical frontiers forged through the present study. First, the sessions designed for the cognitive development intervention were effective in promoting the process whereby interacting peers communicated different understandings of ill-structured problems and arrived at a shared understanding in the course of communicating with each other (Tudge, 1992; Vygotsky, 1978). These sessions fostered the intersubjective process. Second, the intersubjective process was found to transpire in a group setting rather than in a dyadic interaction, such
as the interactions used in previous research with children (Tudge, 1989, 1992; Tudge et al., 1996). Although these group discussions were guided through a modified Prototypic Reflective Judgment Interview (Kitchener et al., 1993) that used probe questions to direct conversation, intersubjectivity was still experienced by participants. Third, these findings indicate that the intersubjective process does operate beyond formal operations into epistemological reflection among first-year college students. Cognitive perspective taking, understanding the structure of others’ abstract reasoning, and engagement with others’ thinking are synonymous with intersubjectivity in formal operations (Dimant & Bearison, 1991; Tjosvold & Johnson, 1977). Fourth, intersubjectivity was effectively measured through two self-report items. The items were created for the present study because, unlike the observational, categorical measurement method used in previous research with children (Tudge, 1992), the self-reported continuous items in the present study capitalized on the developmental abilities of the older adolescents in the sample.

Discussion of research question 4b. Contrary to the hypothesis, intersubjectivity was not correlated with participation. In other words, participants who had higher participation rates did not necessarily experience higher levels of intersubjectivity simply by virtue of attending the sessions and becoming more familiar with other group members. Perhaps there was not sufficient variation in participation (most participants attended almost all session), familiarity did not occur, or familiarity did not serve as the catalyst that cultivated discussions imbued with differing viewpoints, openness and willingness to disagree, or reaching shared understanding. The conceptualization of intersubjectivity as parallel to participation may have underestimated the effectiveness of
intersubjectivity and overestimated the role of mere attendance at sessions in the developmental process.

Discussion of research question 4c. Intersubjectivity did not moderate the relationship between pre-test and post-test epistemological reflection, but it did moderate the relationship between pre-test and follow-up epistemological reflection. At follow-up, pre-test explained $61\%$ of the variance in follow-up epistemological reflection and the interaction term accounted for an additional $3.5\%$ of this variance. The higher the pre-test score, the higher the follow-up score, but this relationship was significantly reduced by intersubjectivity. Unexpectedly, higher intersubjectivity scores were associated with lower rather than higher follow-up epistemological reflection scores. That is, participants who reported higher levels of intersubjectivity were found to have lower follow-up epistemological reflection scores, on average, than participants who reported lower levels of intersubjectivity. When the treatment group was broken into high and low intersubjectivity groups, the lower intersubjectivity group scored higher on follow-up epistemological reflection than the higher group. Participants who reported the lowest levels of intersubjectivity scored higher on follow-up epistemological reflection than all other treatment participants.

These findings reveal that, in this sample, epistemological development does depend on intersubjectivity. However, the direction of effects is negative. Treatment participants who experienced intersubjectivity may have encountered perturbations in their reasoning during discussion sessions because they reported both exposure to and willingness to adopt new unmastered reasoning structures. Cognitive dissonance may
have emerged in the form of slight regression at post-test or delay in development until follow-up among treatment participants who reported the greatest amounts of intersubjectivity.

In contrast, treatment participants who reported the lowest levels of intersubjectivity were, by definition, exposed to new forms of reasoning, but did not report the same levels of willingness to adopt others' reasoning on their own as the high intersubjectivity treatment participants did. In light of the extant research on intersubjectivity, these participants could be classified as nonacceptors because they did not adopt others' reasoning, despite exposure to it (Tudge, 1989, 1992; Tudge et al., 1996). It is possible that these nonacceptors did not experience socio-cognitive conflict or disequilibration, which would have hampered their functional epistemological performance levels at follow-up. Instead, nonacceptors scored highest at follow-up, possibly through accepting new forms of reasoning independently over an extended period of time.

Discussion of research question 5a. Multiple regression analyses failed to confirm the exploratory hypothesis that metacognitive awareness moderated the relationship either between pre-test and post-test or between pre-test and follow-up epistemological reflection. It is possible that this previously-unexplored interaction failed to reach significance because it simply was not there. However, theory suggests it would be. Alternatively, it may be that the effect was undetected by the analytic strategy in this study. It has been suggested (McClelland & Judd, 1993) that interactions are difficult to identify and, when detected, typically account for only 1% to 3% of the total
variance in the dependent variable (as reported in the previously described research question). In this study, the power available to detect interactions was quite low. As a result, restricted range could have rendered this interaction difficult to find. Another potential explanation is that metacognitive awareness does not operate in isolation from other factors to promote epistemological development. As the next set of analyses demonstrate, metacognitive awareness appears to have been bolstered by the intervention experience for treatment participants. Perhaps the role of metacognitive awareness is more complex than Kitchener (1983) originally anticipated in her three-level model of cognitive processes.

Discussion of research question 5b. The final research question in the present study attempted to establish if metacognitive awareness contributed differentially to treatment and control participants epistemological development. It was hypothesized that if metacognitive awareness contributed to the developmental process then, on average, the highest Perry positions after the intervention would be found among treatment participants who reported higher levels of metacognitive awareness. While analyses did not confirm this hypothesized three-way interaction, a lower order two-way interaction of the inverse direction emerged. Statistically, the unique effect of the metacognitive awareness/condition interaction term in Step 6 of a hierarchical multiple regression remained in Step 7, after the significant effects of pre-test epistemological reflection, metacognitive awareness, and the three-way interaction term (i.e., pre-test X metacognitive awareness X condition) were controlled. A total of 53.30% of the variance in follow-up epistemological reflection was explained by this model, with 2.9%
accounted for by the metacognitive awareness/condition interaction term.

The predictive relationship between pre-test and follow-up epistemological reflection was altered as a function of both metacognitive awareness and condition. In the control group, a negative relationship between metacognitive awareness and follow-up epistemological reflection was found. Higher metacognitive awareness scores predicted lower follow-up epistemological reflection scores. In the treatment group, higher metacognitive awareness scores predicted higher follow-up epistemological reflection scores. In other words, the highest follow-up epistemological reflection scores were found in treatment participants who reported the highest levels of metacognitive awareness, while the lowest follow-up scores were found in control participants who reported the highest levels of metacognitive awareness. It can be concluded that treatment group membership appears to have protected participants from regression (or promoted their movement out of their stable post-test position) in follow-up epistemological reflection (i.e., they were protected from experiencing the same rates of regression observed in the control group; their development was enhanced). Participation in the intervention may have buffered the risk of regressing (or facilitated a shift out of stability) in epistemological functioning during the second semester of college.

**Theoretical Contributions**

*The multi-directionality of development.* The findings in the present study offer empirical verification for neo-Vygotskian acceptance that the process of development often involves regression or backwards movement. Traditional Vygotskian theorists believe development is more teleological than recent empirical research and the present
study suggest. More contemporary interpreters of these theories believe the process is multi-directional or at least less unidirectional than once thought (Hogan & Tudge, 1999; Tudge, 1992; Tudge, 1990; Tudge et al., 1996; Tudge & Rogoff, 1989). One notable neo-Vygotskian, Jonathan Tudge, has criticized and attempted to extend Vygotskian theory (Tudge, 1989, 1990, 1992; Tudge & Rogoff, 1989; Hogan & Tudge, 1999). He found that, in reality, both development and regression transpire, and endure (Tudge, 1989) after peers interact to solve problems. Tudge (1992) discovered that a zone of proximal development could be created in the course of discussion between peers. However, rather than assuming that when the zone of proximal development is created it is unfailingly in a developmentally advanced and teleological direction, Tudge’s data (1992, 1996) suggested that such a zone may be formed either in front of or behind a partner’s current level of reasoning (Tudge, 1989, 1992; Tudge et al., 1996).

Consistent with Tudge’s findings, the results of the present study do not fit the traditional Vygotskian position that intersubjective understanding, gained in collaboration with peers, is always in an advanced direction (Tudge, 1992). Perhaps reasoning that is not fully developed or mastered is malleable and can have its development impeded as a result of interaction with less developed peers, leading to slight regression to a previously developed and more-fully-comprehended reasoning structure. The broader interpretation of the zone of proximal development, predicts both development and regression for all interacting partners (Tudge, 1990). Tudge’s findings and thinking extend Vygotsky’s conceptualization of the zone of proximal development (Hogan & Tudge, 1999), and the present study verifies Tudge’s propositions. The findings help to confirm the broadened
understanding of the zone of proximal development (Tudge, 1989, 1992; Tudge et al., 1996). The questions remaining unexplored by previous research as well as the present study are whether there are typical or predictable amounts to which individuals decline, under what conditions, and in which domains of thought (Hogan & Tudge, 1999).

*Intersubjectivity is a change agent.* The present study also offers evidence to support the hypothesis that intersubjectivity is a mechanism (albeit a complex one) for development. As Vygotsky suggested, we need to concentrate not on the product of development, but on the very process by which development is realized (Vygostky, 1978). In the interim, neo-Vygotskians have taken on this charge to discover how to directly account for the role social influences play in development by introducing and exploring the concept of intersubjectivity. While Tudge (1989) concluded that we must take into account the intersubjective processes of interaction (in particular the nature of the information being provided), the results from the present study in general, and the operationalization of the intersubjectivity variable, indicate that individuals’ willingness to accept others’ reasoning could be as important to development as are the interactions and corresponding exposure to novel forms of reasoning.

In the present study, intersubjectivity did appear to operate, over time, as a catalyst for developmental change. Although the treatment participants may have slightly regressed or mainly stabilized during their first semester of college, compared to control participants, they displayed more of a qualitative shift toward embracing advanced forms of reasoning after some time elapsed. As previous research in life-span development has demonstrated, stability or even slight regression is a natural and common aspect of
development. As an example, children often make appropriate and regressive linguistic rule overgeneralization errors as they acquire new language skills (Menn & Stoel-Gammon, 1993; Tager-Flusberg, 1993). They assimilate new words by incorrectly extending rules from words they already learned to pronounce or form. More specifically, if a child who recently learned to use regular past tense verb formation rules overgeneralizes the rule to irregular verbs that were already properly formed (i.e., the child says falled and broked instead of fell and broke) (Menn & Stoel-Gammon, 1993; Tager-Flusberg, 1993), she is illustrating an appropriate regressive pattern of development. The important proposition the present study contributes to the theoretical literature is that intersubjectivity is a change agent that promotes similar patterns in epistemological development, over time, toward complexity of organization, hierarchization, and teleologic movement toward contextual relativism (Baltes et al., 1988; Perry, 1970, 1981).

*Is stability evidence for positions or transitions?* The pronounced stabilization in epistemological reflection scores from pre-test to post-test verifies some of Perry's propositions (1970, 1981) about development. On the one hand, positions are, by definition, static while development is movement (Perry, 1981). On the other hand, prolongation or pause, regression, and temporizing (i.e., delay of movement for a year or more) are all categorized as patterns of deflection from development (Perry, 1970, 1981). The sample's stabilization in epistemological reflection from pre-test to post-test may be an indication of both phenomena. In some cases, participants may have been resting comfortably in one epistemological position through the duration of the first semester or
the duration of the study. In other cases, participants may have regressed, paused, or possibly temporized during these periods of time or through their entire first year of college. Since the design of this study and the analyses performed centered on mean levels, it is difficult to know how many individuals embodied any of these specific trajectories. One possible means through which statistical analysis could more clearly unravel the extent of inter-individual differences in the intra-individual process of development would be to assess hypotheses with multi-level modeling (i.e., random coefficients mixed modeling). However, given the small sample size and the limited number of repeated measures, this approach is not feasible in the current study.

**Metacognitive awareness or metacognitive puzzlement?** The findings of the present study validate Kitchener’s (1983) thinking about metacognitive puzzlement, as suggested above. In her three-level model of cognitive processing, Kitchener (1983) postulated that metacognition involves self-monitoring of cognitive processes. It allows individuals to plan, sequence, and monitor cognitions during problem-solving tasks in a way that is believed to improve performance (King & Kitchener, 2002; Kitchener, 1983; Kitchener et al., 1989). In her description of this model, though, Kitchener also suggests that self-monitoring of cognitive processes often includes metacognitive experiences of puzzlement. It may be that metacognitive puzzlement is reflected by the negative predictive relationship between metacognitive awareness and follow-up epistemological reflection in the sample in the present study, and that more of this metacognitive puzzlement is contributing to higher rates of regression in follow-up epistemological reflection in the control group.
The pattern of results in the treatment group may be representing what Kitchener (1983) refers to as resolution of metacognitive puzzlement. Metacognitive puzzlement, she posited, leads to the re-evaluation of cognitive strategies, the use of different strategies, and the redefinition of tasks. Treatment participants’ experiences during the intervention discussion sessions may have facilitated their ability to resolve metacognitive puzzlement experiences, thus improving their performance on the follow-up epistemological reflection measurement three months after the intervention concluded. If this is true, the present study has expanded on the untested hypothesis of the role of metacognitive awareness in epistemological reflection in an unexpected way. As discussed below, additional research is needed to confirm if this interpretation is accurate.

**Methodological Contributions**

*Measuring intersubjectivity.* The present study employed a novel approach to measuring intersubjectivity. The self-report items that were intended to assess participants’ perceptions (rather than researchers’ observations) of exposure to and adoption of others’ reasoning operated in the intended manner. Furthermore, the computation of the continuous (rather than the categorical) intersubjectivity variable successfully demonstrated that participants experienced intersubjectivity during the cognitive developmental intervention sessions.

An unanticipated discovery emerged through analysis of this measure’s performance across the four discussion sessions in which it was utilized. The absence of intersubjectivity during the peer pressure session, in contrast to its presence during the cognitive sessions, may indicate that intersubjectivity, as measured in this study, is
somewhat more of a cognitive construct than originally proposed. Given that the nature of the topics discussed during the peer pressure sessions were relatively controversial, and participants were asked to share their beliefs about, experiences with, and strategies for negotiating various peer pressure situations (e.g., joining religious groups, interacting with homosexual peers, drinking alcohol, engaging in sexual behavior), it is not surprising that many participants reported higher levels of exposure to others’ reasoning about these topics, yet lower levels of willingness to use the reasoning on their own. Research with this measure should carefully consider its validity in assessing cognitive functioning. That is, the measure is designed to and effectively assesses reasoning, not opinions, points of view, attitudes, or beliefs.

The Measure of Epistemological Development. This study was the first to combine a five-domain measure of epistemological development with a 10-point scoring system that assesses the Perry positions as well as transitions between the positions (Perry 1970, 1981). The combination of these two well-established methods for measuring epistemological development (Baxter-Magolda & Porterfield, 1985; Baxter-Magolda, 1987, 2001; Moore, 1989, 1990) permits the researcher to obtain far more refined measurement of developmental stages and the gradual progression through them (i.e., the process of development) than current indices. Previous research already demonstrates that development progresses in a sequential manner, but individuals do not reason at the same stage in all situations (Davison et al., 1990; King et al., 1983; Kitchener & King, 1981; Kitchener et al., 1989; Schmidt, 1985). Instead, individuals use adjacent stages across domains in their reasoning. Furthermore, asynchrony in stage
scores across domains of thought is common and measuring participants’ levels of functioning should eventuate in a reasonable modal estimate (Davison et al., 1990; King et al., 1983; King & Kitchener, 1994; King & Kitchener, 2002, Kitchener et al., 1989). Although differences between the mean scores found in the present study and mean scores reported in the literature could be accounted for by the creation of the MED, this measure is unique because it acknowledges the issues of sequentiality and consistency of stages across domains, hence it undertakes a more fine-grained, process-oriented approach to measuring epistemological development than previous instruments.

*Intervention Applications*

Two practical realities emerge through the findings of this study. First, researchers, educators, administrators, and instructors who work with college students must acknowledge that students’ mere presence in intervention programs, campus-based programming events, or classrooms does not assure us that they will be engaged in or reap the developmental benefits of intersubjective discussions with others. The process of development in college students’ critical thinking involves active engagement in content-focused peer-to-peer discussions. The structure of these discussions should (a) challenge students to partake in conversations about different points of view and to contribute to open disagreement with one another, while (b) supporting students by offering contexts that allow them to defend their propositions and dispute intellectual controversies. Attending classes and acting as repositories for information are simply not sufficient for the development of critical thinking.

Second, once treatment participants’ three epistemological reflection scores were
visually scanned, it became apparent that some students simply would not change until
they were ready to do so. At least four of the treatment participants in this study appear
either to have paused or temporized, despite involvement in the intervention. Simply,
intervention may not facilitate growth for some students.

The last observation mentioned above can be understood in terms of dialectical
materialism. The design of this study broadly applies the contextualist developmental
perspective, which encompasses Vygotsky’s perspective called dialectical materialism
(Vygostky, 1978; Tudge & Rogoff, 1989). Contextualism posits that the boundaries
between the individual and the environment are blurred and the influence of interacting
partners cannot, either in principle or in reality, be separated because they are, at once,
both social and psychological (Tudge & Winterhoff, 1993). In dialectical materialism,
development is a process of dialectical transformation of social and internal entities
(Tudge & Rogoff, 1989; Tudge, 2000). The social environment and psychological
processes are dynamically interacting and mutually embedded forces in action. As cited
by Tudge and Winterhoff (1993), Vygotsky noted that, “In collaboration, the (adolescent)
can always do more than he can independently, but we must add the stipulation that he
cannot do infinitely more” namely because limits are set by maturation and natural
intellectual potential. Peers bring their current levels of functioning to problem-solving
tasks, which establishes the boundaries within which the interaction has an impact on
their subsequent development. In essence, there are organismic limits to the impact
researchers, educators, administrators, and instructors can have on their students'
developmental trajectories.
Notwithstanding, a majority of students do appear to develop; therefore, educational practice could be informed by the theoretical foundation and findings in the present study. As noted above, it is imperative that educators "engage" students in the educational process. Interested and thoughtful participation should be encouraged through frequent class discussions. Students need to attend class to benefit from their peers' perspectives on course material; therefore, educators should consider interesting methods of teaching that would bolster students' inclination to go to class and participate in discussions. During discussions students could be asked, by name, to share their understanding of material. They could be asked what they think, how they could illustrate topics through real-life examples, how they might argue for theoretical positions, how they might disagree with authors' perspectives. Simultaneously, course structure should ensure active involvement with course material outside of the classroom. Assignments should be designed to enhance involvement with material while students read, study, and prepare for exams by requiring them to think about the various points of view, arguments, and justifications for arguments that are presented during class discussions.

One way to facilitate this type of educational process would be to share the MED scoring system with faculty and students. The rating cues could be presented to faculty to enable them to assess their students' epistemological functioning and to subsequently challenge students to reach for the next reasoning structure, while supporting their attempts to do so (Roark, 1989). The rating cues could also be present to students in classrooms, so they could see more complex reasoning structures: The reasoning
structures they may use in the future. Some students will naturally want to reach for the highest positions, while others will affirm that they already reason at those levels. Regardless, of their self assessments, students should be challenged to explicate what the positions mean to them, so that they could more firmly grasp the reasoning structures.

Another useful theoretically-informed pedagogical strategy educators could use would be to maintain variety. Given that a majority of college students function from position three which embraces variety, educators could capitalize on this developmental asset by spending time in each class discussion addressing the needs of each position. Educators could (a) describe “right” answers for students who function in position two, (b) ask students to offer different points of view or explore “unknown” answers to questions to reach students who function in position three, (c) encourage students to defend their points of view, compare and contrast opinions, and discover which ones are “better” to reach students who function in position four, (d) and confirm that the “better” arguments are the “correct” ones to reach students who function in position two. Through this method, students in each position could hear what their reasoning structure embraces while listening to a variety of opinions and reasoning structures. This use of variety would enhance students’ engagement.

Some Competing and Explanatory Hypotheses

Several reasons come to mind to explain why relatively little change in epistemological reflection was revealed in the present study. First, it is feasible that there may be a confound between each student’s actual level of functioning at each time point and their scores at these time points. This confound may be attributed to the manner in
which the MED responses were scored. In this study, coders scored each wave of data separately after the data were collected. Perhaps, by post-test, as coders learned and grew comfortable with the scoring of participants’ responses (particularly the predominance of position-three justifications for reasoning structures), coders’ interpretations of responses tended to regress toward the sample mean. It is reasonable to expect that participants’ scores themselves regressed toward the mean. If regression to the mean did occur, one approach to coding that could disentangle the means by which this phenomenon existed would be to score all three waves of responses after all data were collected. However, for purposes of this study, time constraints required data to be coded after each wave of data collection, throughout the duration of the study.

Second, it is possible that the method by which data were collected interfered with the reliability of the MED. Pre-test measures were sent to participants’ home addresses before they entered college. In the summer, participants could take as much time as they wanted to complete the measure. When asked in the Fall, some participants stated that they took hours to complete the summer measure, others mentioned that they completed it over the course of several days. During questionnaire-completion sessions in December and March; however, students were required to sit in a conference room on campus and complete the measure in no more than 90 minutes. Conceivably, participants hurried or did not put as much thought into their responses at post-test and follow-up as they did at pre-test, compromising their performance and comparatively reducing mean scores. However, for purposes of the present study, students were asked to complete the MED in the group setting to ensure that the measure was completed by as many students
as possible. This methodological strategy was employed because, oftentimes, in the frenzy of college life students fail to independently complete voluntary tasks or they forget to send completed forms back to original senders unless they do complete instruments in administrative locations on campus.

Third, some higher education economists believe the impact of a college education is commensurate with the quality of the peers at the institution (Winston & Zimmerman, 2003). These authors assert that strong students tend to increase their peers' intellectual abilities and academic performance, while weak students tend to reduce their peers' intellectual abilities and academic performance. Further, they propose that the quality of students is part of the product that expensive and selective universities sell. Expensive and selective universities attract the best students, which enhances the quality of those institutions (Winston & Zimmerman, 2003). Given that the university at which the students in the present study were enrolled was not considered to be either expensive or selective, it is plausible that participants' peers and interactions with these peers in various settings across this campus could have hampered participants cognitive development during their first two semesters at the university. One methodological approach to explore this competing hypothesis, beyond the scope of this study, would be to simultaneously replicate the study at a cross-section of universities that vary in their first-year curriculum, overall cost, and institutional selectivity.

Limitations

In addition to the limitations that have already been noted (e.g., power, the MED coding methods, epistemological reflection scores possibly regressing toward the mean),
three additional issues should be considered before interpreting results and drawing conclusions about the developmental trajectories represented by the data as well as their generalizability. These issues pertain to (a) time constraints, (b) comparisons between the measure used in this study and measures used in the literature, and (c) the uniqueness of the sample.

Time constraints precluded the assessment of multiple follow-up waves of data. The duration of this study captured change within nine months, but that may be too short of a period of time to assess true developmental change. Perhaps, if more time elapsed between the intervention and follow-up measurement periods, upward trajectories may have been obtained. Developmental researchers debate Baltes and colleagues' (1988) statement that to classify change as developmental, it must be lasting, not temporary. How long is lasting, not temporary? How many times should a construct be measured to determine whether development has occurred? Isn't the temporary transition to another position (i.e., a resting point at a new level of complexity and greater hierarchization) the very process of development that this study aimed to assess? It is difficult to determine whether the follow-up analyses in this study captured students resting in positions or students moving through transitions (Perry, 1970, 1981). A combination of both phenomena could be explored in the future with random-coefficients mixed models.

It is also difficult to compare these results to the findings in the literature. In Chapter 2 it was noted that the bulk of the empirical literature surrounding college students' cognitive development has been written by Kitchener, King, and colleagues (Davison et al., 1990; King & Kitchener, 1994; King & Kitchener, 2002; King et al.,
1983; Kitchener & Fischer, 1990; Kitchener & King, 1981; Kitchener et al., 1989; Schmidt, 1985). While these authors referred to Perry's scheme (1970) as an initial theoretical framework, they used the Reflective Judgment Interview to collect their data. The present study reverted to the Perry tradition to measure and score Perry's positions. Do the Reflective Judgment Interview (RJI) and the Measure of Epistemological Development (MED) reliably measure the same construct? Future research with the MED could include convergent validity tests between it, the RJI, the MER, and the MID.

One last limitation involves the sample. Participants in this study were chosen because they could be classified as first-year at-risk honors students. They were minority students, Native-Americans from reservation schools, first-generation college students, students from minority schools or rural schools or schools with less rigorous academic programs, or young students. This heterogeneous risk group prevents us from generalizing findings either to minority, at-risk adolescent, under-represented, majority, or honors college students or from testing for differences between groups. This sample is unique and results should be interpreted accordingly.

Future Directions

There are four potential future directions for research on the cognitive developmental process during the college years. First, with respect to intersubjectivity, while the items in the present study were an initial step from theory to empirical practice, some points of criticism should be suggested. The intersubjectivity measure in the present study did not fully capture participants' intersubjective experiences and it did not account for varying interpretations of the items.
The present study did not attempt to measure the extent to which intersubjectivity elicited feelings of socio-cognitive conflict as well as possible connections between socio-cognitive conflict and disequilibration. Future research may investigate the specific components of intersubjectivity (i.e., exposure to and acceptance of other reasoning structures) and the degree to which combinations of these components contribute to feelings of socio-cognitive conflict by combining the self-report measure with observational studies of peers interacting to solve problems similar to the ones presented in this study. Observational videotaped data could be mapped onto participants' self-report responses to assess whether the two sets of information measure the same construct. Such an approach could confirm whether theoretically-derived researcher observations capture the same process and experience that is reported by participants. Additionally, focus groups could involve participants viewing and describing their experiences during the problem-solving discussions.

It is feasible that the language of the intersubjectivity items threatened the validity of the measure. Possibly, the items were interpreted differently by different participants depending on the conversational context and content, the history of interactions within each discussion group, or the degree of participants' active involvement with differing reasoning structure during the discussion sessions. Future research should attempt to test the items by administering variations in the language of the intersubjectivity items (e.g., insert would, could, be able to, or are inclined to in the adopted reasoning item) or seeking participants' comments about their understanding and interpretation of the items. Further, various validity tests could be pursued. Convergent validity could test the
effectiveness of these variations in the items. Construct validity could explore the validity of the items across content domains. Divergent validity may explore whether intersubjectivity is different in groups versus during dyadic interactions versus in non-interactive settings (e.g., television viewing, book reading).

Similarly, the intersubjective milieu measure in the present study may not have really assessed participation, involvement, or engagement. It may have served as a weak proxy for this phenomenon, as well. As noted for intersubjectivity, qualitative assessment of participants’ perceptions of the intersubjective milieu, both in the form of mapping observations and self-reports and participant-focused description of the experience may prove advantageous in future research.

Second, it appears as though more work could also be done to clarify the role of metacognitive awareness in epistemological reflection during the college years. One the one hand, it could be that the present study did not find that metacognitive awareness is a moderator of epistemological change because the psychometric properties of the new Measure of Epistemological Development in some way compromised the statistical relationships between the variables in the multivariate models, hampering the ability to reject the null hypothesis. On the other hand, it is possible that research should develop a measure of metacognitive puzzlement and it’s resolution. Through this study it is still difficult to determine whether the intervention facilitated participants’ metacognitive awareness or their ability to resolve metacognitive puzzlement.

Third, future research could incorporate more longitudinal designs that assess epistemological development during students’ second semester of college, toward the end
of their first year, in the following summer, and through the succeeding undergraduate years. This work could more fully explore whether inter-individual or intra-individual patterns of regression, pause, or temporization occur during the transition to college or at other predictable points through students' undergraduate careers.

Last, and perhaps most important, future research could identify and implement the most effective strategies that enable us to understand and promote the epistemological development of the future citizens of America society. Students are increasingly coming from very different backgrounds, including minority cultural populations who understand the world from a multicontextual framework (i.e., they interpret holistic patterns of information to infer contextual meaning about events and interactions; Ibarra, 1999). The demographic trends of contemporary higher education illustrate the growing reality that the traditional Western linear way of thinking may no longer be universal in higher education. Consequently, while the Perry scheme was relevant during the mid- to late-20th Century, it is possible that it should be revised to capture epistemological functioning in our increasingly diverse and relativistic world. There may be new forms of reasoning which we have not measured yet because the Perry scheme and related instruments continually measure a pre-established set of reasoning structures. Are there more complex or different forms of reasoning the Perry scheme has not assessed yet? Are more post-modern measurement techniques appropriate now? One positivist way to answer these questions would be to undertake many more quantitative studies of the Perry scheme with diverse samples. One post-positivist approach may be to start anew,
as Perry did earlier in the 20th Century, by administering the CLEV among diverse groups of college students and developing a revised Perry scheme.

In essence, we may discover that the epistemologies which are captured by the current Perry scheme may not be appropriate in contexts outside of higher education. Some walks of life and professions do not require linear reasoning, but rather innovative, entrepreneurial, creative thinking. A well-developed society may be most adaptive if new ideas and innovations consistently arise and these discoveries often come from people who have non-linear patterns of thought. Furthermore and as an example, it may not be appropriate in some sub-cultures or environments to question authority. An expanded appreciation of the spectrum of epistemological possibilities would be important because it could enable us to understand and assist students from these cultures to develop at a level of critical thinking upon which they could differentiate, for example, when it would be appropriate and how it would be acceptable and effective to question authority. In other words, a critical evaluation of the Perry scheme could prepare educators to lead our increasingly diverse student population to thoughtful decisions that will be adaptive in their worlds and that will shape their lives and the lives of others.

Educators, researchers, and intervention experts should pursue a critical evaluation of the purpose of higher education and the impact it has on contemporary college students’ critical thinking. The original aims of Colonial education were to develop responsible, productive, and literate citizens who could participate in and serve American society (Thelin, 1996). If today’s purpose of higher education is similar, we must identify and implement the most effective peer-based pedagogical techniques to
more effectively educate, better understand, and collectively promote the cognitive developmental process and epistemological development of contemporary student populations, all of whom will become the American citizens of the future.
Footnote

In June of 2003, a permission form for use of the MER and a request for the MER Rating Manual were submitted to Baxter-Magolda. Rather than granting permission, Baxter-Magolda advised that a similar questionnaire be constructed because her newest constructivist interpretation of students' decision-making and learning-oriented responses to the MER did not demonstrate the high interrater reliability and internal consistency of the original MER scoring. As a result, a shortened five-domain version of the original MER was used in this study (i.e., the decision-making domain was removed). This Measure of Epistemological Development (MED) is closer to Perry's cognitive theory and more appropriate to reveal, in statistical models, the developmental process underly movement through Perry's stages than Baxter-Magolda's newly-created interpretation and rating system (personal communication).

Baxter-Magolda understood why an approach closer to the Perry tradition was preferred over her new constructivist rating system; therefore, she recommended that consideration be given to Moore's Measure of Intellectual Development (MID), which is close to the MER in style, and scored according to the Perry scheme (personal communication). Upon review of the MID Instrument Manual (Moore, 1990), it was determined that the MED would provide an opportunity to collect richer data, greater specificity in measurement, and greater control in students' responses over a larger number of domains of thinking, thus providing greater accuracy in measuring epistemological reflection than the open-ended, under-specified, single-domain MID. In addition, unlike the MID, the MED elicited students' reasons for their thinking, which
enabled scorers to assess justifications for responses and which further enhanced accuracy in measuring epistemological reflection.
Table 1
Sample Demographics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Recruited sample&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Participants&lt;sup&gt;b&lt;/sup&gt;</th>
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<tbody>
<tr>
<td></td>
<td>(N)</td>
<td>%</td>
</tr>
<tr>
<td>Students from predom minority schools</td>
<td>74</td>
<td>15.68</td>
</tr>
<tr>
<td>Students from less rigorous high schools</td>
<td>74</td>
<td>15.68</td>
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<tr>
<td>Students from rural high schools</td>
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<td>31.99</td>
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<tr>
<td>Transfer students</td>
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<td>19.91</td>
</tr>
<tr>
<td>Younger than average students (&lt;16)</td>
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<td>1.06</td>
</tr>
<tr>
<td>Women</td>
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<td>58.47</td>
</tr>
<tr>
<td>Caucasians</td>
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<td>52.33</td>
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<tr>
<td>Asians</td>
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<td>16.31</td>
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<td>-</td>
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<tr>
<td>African-Americans</td>
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<td>1.91</td>
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<td>Native-Americans</td>
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</tr>
<tr>
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<td>2.97</td>
</tr>
<tr>
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<td>-</td>
</tr>
<tr>
<td>Mixture of Eng &amp; non-Eng spoken at home</td>
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<td>-</td>
</tr>
<tr>
<td>Mostly non-English spoken at home</td>
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<td>-</td>
</tr>
<tr>
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<tr>
<td>Not born in the United States</td>
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<td>-</td>
</tr>
<tr>
<td>First-generation college students</td>
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<td>-</td>
</tr>
</tbody>
</table>

Note: Some categories overlap. A dash denotes unknown.

<sup>a</sup>There were 472 recruited students.  <sup>b</sup>There were 83 participants.
<table>
<thead>
<tr>
<th>Demographics</th>
<th>Treatment group&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Control group&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Students from predom minority schools</td>
<td>7</td>
<td>.14</td>
</tr>
<tr>
<td>Students from less rigorous high schools</td>
<td>7</td>
<td>.14</td>
</tr>
<tr>
<td>Students from rural high schools</td>
<td>24</td>
<td>.48</td>
</tr>
<tr>
<td>Transfer students</td>
<td>5</td>
<td>.10</td>
</tr>
<tr>
<td>Younger than average students (&lt; 16)</td>
<td>0</td>
<td>.00</td>
</tr>
<tr>
<td>Women</td>
<td>34</td>
<td>.68</td>
</tr>
<tr>
<td>Caucasians</td>
<td>25</td>
<td>.50</td>
</tr>
<tr>
<td>Asians</td>
<td>7</td>
<td>.14</td>
</tr>
<tr>
<td>Multi-racial</td>
<td>8</td>
<td>.16</td>
</tr>
<tr>
<td>Hispanics</td>
<td>9</td>
<td>.18</td>
</tr>
<tr>
<td>African-Americans</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>Native-Americans</td>
<td>0</td>
<td>.00</td>
</tr>
<tr>
<td>&quot;Other&quot; ethnicity</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>Mostly English spoken at home</td>
<td>44</td>
<td>.88</td>
</tr>
<tr>
<td>A Mixture of English and non-English spoken at home</td>
<td>6</td>
<td>.12</td>
</tr>
<tr>
<td>Mostly non-English spoken at home</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>Born in the United States</td>
<td>46</td>
<td>.92</td>
</tr>
<tr>
<td>Not born in the United States</td>
<td>5</td>
<td>.10</td>
</tr>
<tr>
<td>First-generation college students</td>
<td>5</td>
<td>.10</td>
</tr>
<tr>
<td>Liberal arts, soc sci, humanities majors</td>
<td>18</td>
<td>.36</td>
</tr>
<tr>
<td>Science and engineering majors</td>
<td>28</td>
<td>.56</td>
</tr>
<tr>
<td>Undecided majors</td>
<td>3</td>
<td>.06</td>
</tr>
</tbody>
</table>

*Note.* Some categories overlap.

<sup>a</sup>There were 50 participants in the treatment group. <sup>b</sup>There were 33 participants in the control.
Table 3

Treatment and Control Group Compositions (Gender, Ethnicity, Year, and Major)

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Group 1 (N=10)</th>
<th>Group 2 (N=8)</th>
<th>Group 3 (N=9)</th>
<th>Group 4 (N=11)</th>
<th>Group 5 (N=12)</th>
<th>Control (N=33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Caucasian</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>Asian</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Multi-racial</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Hispanic</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>African-American</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Native-American</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>&quot;Other&quot; ethnicity</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>First-year students</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>30</td>
</tr>
<tr>
<td>Sophomores</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Juniors</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Lib art, soc sci, hum maj</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Science and eng majors</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Undecided majors</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Unknown majors</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. Assignment to specific treatment discussion groups was based on students' availability schedules. Smaller or more homogeneous groups are a reflection of scheduling difficulties.
Table 4

Descriptive Statistics for Pre-Test, Post-Test, Follow-Up Epistemological Reflection, and Metacognitive Awareness

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Skew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test epistemological reflection</td>
<td>83</td>
<td>3.07</td>
<td>.28</td>
<td>2.33</td>
<td>4.47</td>
<td>1.30</td>
</tr>
<tr>
<td>Post-test epistemological reflection*</td>
<td>80</td>
<td>3.06</td>
<td>.20</td>
<td>2.47</td>
<td>3.53</td>
<td>-.19</td>
</tr>
<tr>
<td>Follow-up epistemological reflection*</td>
<td>74</td>
<td>3.11</td>
<td>.26</td>
<td>2.34</td>
<td>3.80</td>
<td>-.39</td>
</tr>
<tr>
<td>Metacognitive awareness</td>
<td>80</td>
<td>6.57</td>
<td>1.12</td>
<td>2.80</td>
<td>9.14</td>
<td>-.43</td>
</tr>
</tbody>
</table>

Note. *The sample mean at post-test was not significantly different from the sample mean at pre-test ($t = .34, p = .73$). †The sample mean at follow-up was significantly higher than the sample mean at pre-test ($t = -2.60, p < .01$).
### Table 5

**Frequency Distribution of the Sample's Pre-Test, Post-Test, and Follow-Up Epistemological Reflection Scores**

<table>
<thead>
<tr>
<th>Epistemological reflection score</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Position 2.33 to 2.66</td>
<td>2</td>
<td>2.40</td>
<td>2</td>
</tr>
<tr>
<td>Position 2.67 to 2.99</td>
<td>27</td>
<td>32.50</td>
<td>21</td>
</tr>
<tr>
<td>Position 3.00 to 3.32</td>
<td>40</td>
<td>48.00</td>
<td>47</td>
</tr>
<tr>
<td>Position 3.33 to 3.66</td>
<td>11</td>
<td>13.50</td>
<td>10</td>
</tr>
<tr>
<td>Position 3.67 to 3.99</td>
<td>2</td>
<td>2.40</td>
<td></td>
</tr>
<tr>
<td>Position 4.00 to 4.32</td>
<td>1</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td>Position 4.33 to 4.66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 4.67 to 4.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>100.00</td>
<td>80</td>
</tr>
</tbody>
</table>

*Note.* In Position 2 truth is considered to be absolute. In Position 3 truth can only be uncertain temporarily. In Position 4 truth is accepted to be uncertain in many cases.
Table 6

Frequency Distribution of the **Treatment Group**'s Pre-Test, Post-Test, and Follow-Up Epistemological Reflection Scores

<table>
<thead>
<tr>
<th>Epistemological reflection score</th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
<th></th>
<th>Follow-up</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Position 2.33 to 2.66</td>
<td>2</td>
<td>4.00</td>
<td>1</td>
<td>2.00</td>
<td>1</td>
<td>2.10</td>
</tr>
<tr>
<td>Position 2.67 to 2.99</td>
<td>12</td>
<td>24.00</td>
<td>15</td>
<td>30.00</td>
<td>6</td>
<td>12.70</td>
</tr>
<tr>
<td>Position 3.00 to 3.32</td>
<td>27</td>
<td>54.00</td>
<td>28</td>
<td>56.00</td>
<td>28</td>
<td>59.60</td>
</tr>
<tr>
<td>Position 3.33 to 3.66</td>
<td>7</td>
<td>14.00</td>
<td>6</td>
<td>12.00</td>
<td>11</td>
<td>23.40</td>
</tr>
<tr>
<td>Position 3.67 to 3.99</td>
<td>2</td>
<td>4.00</td>
<td></td>
<td></td>
<td>1</td>
<td>2.10</td>
</tr>
<tr>
<td>Position 4.00 to 4.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 4.33 to 4.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 4.67 to 4.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100.00</td>
<td>50</td>
<td>100.00</td>
<td>47</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Note*. In Position 2 truth is considered to be absolute. In Position 3 truth can only be uncertain temporarily.

In Position 4 truth is accepted to be uncertain in many cases.
Table 7

Frequency Distribution of the Control Group's Pre-Test, Post-Test, and Follow-Up Epistemological Reflection Scores

<table>
<thead>
<tr>
<th>Epistemological reflection score</th>
<th>Pre-test</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Position 2.33 to 2.66</td>
<td>1</td>
<td>3.30</td>
<td>1</td>
<td>3.70</td>
</tr>
<tr>
<td>Position 2.67 to 2.99</td>
<td>15</td>
<td>45.60</td>
<td>6</td>
<td>20.10</td>
</tr>
<tr>
<td>Position 3.00 to 3.32</td>
<td>13</td>
<td>39.40</td>
<td>19</td>
<td>63.30</td>
</tr>
<tr>
<td>Position 3.33 to 3.66</td>
<td>4</td>
<td>12.00</td>
<td>4</td>
<td>13.30</td>
</tr>
<tr>
<td>Position 3.67 to 3.99</td>
<td>1</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 4.00 to 4.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 4.33 to 4.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position 4.67 to 4.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.00</td>
<td>30</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Note. In Position 2 truth is considered to be absolute. In Position 3 truth can only be uncertain temporarily. In Position 4 truth is accepted to be uncertain in many cases.
Table 8
Means and Standard Deviations for Pre-Test, Post-Test, and Follow-Up Epistemological Reflection, and Metacognitive Awareness by Condition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>50</td>
<td>3.07</td>
</tr>
<tr>
<td>Post-test epistemological reflection*</td>
<td>50</td>
<td>3.06</td>
</tr>
<tr>
<td>Follow-up epistemological reflection</td>
<td>47</td>
<td>3.15</td>
</tr>
<tr>
<td>Metacognitive awareness*</td>
<td>50</td>
<td>6.77</td>
</tr>
</tbody>
</table>

Note. *The treatment group mean at post-test was not significantly different from the control group mean at post test \( (t = .24, p = .81) \). *bThe treatment group mean at follow-up was significantly higher than the control group mean at follow-up \( F(df = 2, 7.06, p < .01) \).
Table 9

Descriptive Statistics for Program Participation and Intersubjective Milieu

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program participation rates</td>
<td>50</td>
<td>7.08</td>
<td>1.04</td>
<td>4.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Intersubjective milieu</td>
<td>50</td>
<td>7.69</td>
<td>.93</td>
<td>5.47</td>
<td>9.31</td>
</tr>
</tbody>
</table>
Table 10
Descriptive Statistics for Intersubjectivity Ratings

<table>
<thead>
<tr>
<th>Intersubjectivity (isjy) variable</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peer pressure session</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure to reasoning</td>
<td>46</td>
<td>7.78</td>
<td>1.59</td>
<td>3.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Adopted reasoning</td>
<td>46</td>
<td>7.61</td>
<td>1.88</td>
<td>3.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Peer pressure isjy</td>
<td>46</td>
<td>-0.17</td>
<td>1.57</td>
<td>-7.00</td>
<td>4.00</td>
</tr>
<tr>
<td><strong>Academic expectations session</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure to reasoning</td>
<td>44</td>
<td>7.54</td>
<td>1.81</td>
<td>3.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Adopted reasoning</td>
<td>44</td>
<td>7.61</td>
<td>1.48</td>
<td>4.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Academic expectations isjy</td>
<td>44</td>
<td>0.07</td>
<td>1.39</td>
<td>-2.00</td>
<td>4.00</td>
</tr>
<tr>
<td><strong>Chemical additives session</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure to reasoning</td>
<td>45</td>
<td>7.71</td>
<td>1.98</td>
<td>2.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Adopted reasoning</td>
<td>45</td>
<td>7.93</td>
<td>1.67</td>
<td>3.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Chemical additives isjy</td>
<td>45</td>
<td>0.22</td>
<td>1.49</td>
<td>-3.00</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>Construction of the pyramids session</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure to reasoning</td>
<td>38</td>
<td>8.18</td>
<td>1.91</td>
<td>1.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Adopted reasoning</td>
<td>38</td>
<td>8.29</td>
<td>1.43</td>
<td>3.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Construction of the pyramids isjy</td>
<td>38</td>
<td>0.11</td>
<td>1.90</td>
<td>-3.00</td>
<td>8.00</td>
</tr>
<tr>
<td><strong>Non-cognitive isjy</strong></td>
<td>50</td>
<td>0.02</td>
<td>1.38</td>
<td>-3.00</td>
<td>4.00</td>
</tr>
<tr>
<td><strong>Cognitive isjy</strong></td>
<td>50</td>
<td>0.22</td>
<td>1.43</td>
<td>-3.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Difference in isjy (cog - non)</td>
<td>50</td>
<td>0.20</td>
<td>2.03</td>
<td>-5.50</td>
<td>7.00</td>
</tr>
<tr>
<td>Mean isjy across four sessions</td>
<td>50</td>
<td>0.13</td>
<td>0.88</td>
<td>-1.67</td>
<td>2.00</td>
</tr>
</tbody>
</table>

*Note.* Intersubjectivity was computed as "exposure" minus "adopted"; therefore, positive intersubjectivity scores reflect the presence of intersubjectivity.
Table 11

Descriptive Statistics for Treatment Participants' Reports on Intersubjective Milieu

<table>
<thead>
<tr>
<th>Intersubjective condition</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaged in a discussion with peers</td>
<td>7.67</td>
<td>1.53</td>
<td>3.57</td>
<td>10.00</td>
</tr>
<tr>
<td>Discussion pertained to the topic at-hand</td>
<td>8.34</td>
<td>.99</td>
<td>5.33</td>
<td>9.88</td>
</tr>
<tr>
<td>Presence of different points of view</td>
<td>6.91</td>
<td>1.39</td>
<td>2.50</td>
<td>9.38</td>
</tr>
<tr>
<td>Balance in disagreement</td>
<td>6.42</td>
<td>1.60</td>
<td>1.50</td>
<td>9.38</td>
</tr>
<tr>
<td>Felt open and willing to disagree^</td>
<td>8.51</td>
<td>1.15</td>
<td>5.20</td>
<td>10.00</td>
</tr>
<tr>
<td>People could make propositions, defend opinions</td>
<td>8.27</td>
<td>1.14</td>
<td>5.67</td>
<td>10.00</td>
</tr>
</tbody>
</table>

*Note. N = 50. *Balance in disagreement was statistically different from willingness to disagree (t = -8.72, p < .001).
Table 12

Intercorrelations among Epistemological Reflection, Epistemological Development, Program Participation Rates, Intersubjective Milieu, and Metacognitive Awareness by Condition

<table>
<thead>
<tr>
<th>Variable</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Pre-test epistemological reflection</td>
<td></td>
<td>.49**</td>
<td>.41**</td>
<td>-.79****</td>
<td>-.40**</td>
<td></td>
<td></td>
<td>.08</td>
</tr>
<tr>
<td>B. Post-test epistemological reflection</td>
<td>.51****</td>
<td></td>
<td>.55***</td>
<td>.14</td>
<td>.02</td>
<td></td>
<td></td>
<td>.02</td>
</tr>
<tr>
<td>C. Follow-up epistemological reflection</td>
<td>.78****</td>
<td>.67****</td>
<td></td>
<td>-.02</td>
<td>.66****</td>
<td></td>
<td></td>
<td>-.14</td>
</tr>
<tr>
<td>D. Epistemological dev at post-test</td>
<td>-.66****</td>
<td>.30**</td>
<td>-.31**</td>
<td></td>
<td>.44**</td>
<td></td>
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<td>-.08</td>
</tr>
<tr>
<td>E. Epistemological dev at follow-up</td>
<td>-.41***</td>
<td>.14</td>
<td>.24*</td>
<td>.60****</td>
<td></td>
<td></td>
<td></td>
<td>-.34*</td>
</tr>
<tr>
<td>F. Program participation rates</td>
<td>.01</td>
<td>-.14</td>
<td>.03</td>
<td>-.13</td>
<td>-.00</td>
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<td></td>
</tr>
<tr>
<td>G. Intersubjective milieu</td>
<td>-.07</td>
<td>-.21</td>
<td>-.13</td>
<td>-.11</td>
<td>-.06</td>
<td>.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Metacognitive awareness</td>
<td>.06</td>
<td>.14</td>
<td>.13</td>
<td>.05</td>
<td>.12</td>
<td>.00</td>
<td>.10</td>
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</tr>
</tbody>
</table>

Note. Control group correlations appear on the upper half of the matrix. Treatment group correlations appear on the lower half of the matrix. A blank denotes information is not applicable to the group.

*p < .10. **p < .05. ***p < .01. ****p < .001.
Table 13

Intercorrelations among Treatment Participants’ Participation Rates and Intersubjectivity Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Intersubjective milieu</td>
<td></td>
<td>.21</td>
<td>.27*</td>
<td>-.06</td>
<td>.47****</td>
<td>.39***</td>
<td>-.18</td>
<td>.56****</td>
<td>.47***</td>
<td>-.21</td>
<td>-.25*</td>
<td>-.04</td>
</tr>
<tr>
<td>B. Participation rates</td>
<td></td>
<td></td>
<td>.00</td>
<td>-.27*</td>
<td>.06</td>
<td>.04</td>
<td>-.05</td>
<td>-.23</td>
<td>-.26</td>
<td>.04</td>
<td>-.01</td>
<td>-.17</td>
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<tr>
<td>C. Peer pressure isjy</td>
<td></td>
<td></td>
<td></td>
<td>.25</td>
<td>.00</td>
<td>-.04</td>
<td>-.04</td>
<td>.15</td>
<td>-.17</td>
<td>-.28</td>
<td>-.20</td>
<td>.47****</td>
</tr>
<tr>
<td>D. Aca expectations isjy</td>
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<td></td>
<td></td>
<td></td>
<td>-.06</td>
<td>.07</td>
<td>.15</td>
<td>.02</td>
<td>.04</td>
<td>.01</td>
<td>.06</td>
<td>.68****</td>
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<td>E. Chem additive exposure</td>
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<td></td>
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<td>.68****</td>
<td>-.57****</td>
<td>.56****</td>
<td>.31*</td>
<td>-.32*</td>
<td>-.51****</td>
<td>-.45***</td>
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<tr>
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<td></td>
<td></td>
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<td>.48****</td>
<td>.37**</td>
<td>-.21</td>
<td>-.12</td>
<td>-.11</td>
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<tr>
<td>G. Chem additive isjy</td>
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<td>-.29*</td>
<td>-.06</td>
<td>.25</td>
<td>.81****</td>
<td>.48****</td>
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<td>H. Pyramids exposure</td>
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<td></td>
<td>.38**</td>
<td>-.72****</td>
<td>-.68****</td>
<td>-.48***</td>
</tr>
<tr>
<td>I. Pyramids adopted</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.37**</td>
<td>.25</td>
<td>.16</td>
</tr>
<tr>
<td>J. Pyramids isjy</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>.87****</td>
<td>.61****</td>
</tr>
<tr>
<td>K. Cognitive isjy</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.53****</td>
</tr>
<tr>
<td>L. Mean isjy</td>
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</tr>
</tbody>
</table>

*p < .10. **p < .05. ***p < .01. ****p < .001. *isjy is the abbreviation for intersubjectivity.
Table 14

**Pre-Test to Post-Test Correlations among the Five Epistemological Reflection Domains**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Post-test learner</th>
<th>Post-test instructor</th>
<th>Post-test peers</th>
<th>Post-test evaluation</th>
<th>Post-test knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test - the role of the learner</td>
<td>.39****</td>
<td>.31***</td>
<td>.33***</td>
<td>.16</td>
<td>.25**</td>
</tr>
<tr>
<td>Pre-test - the role of the instructor</td>
<td>.33***</td>
<td>.23**</td>
<td>.28***</td>
<td>.23**</td>
<td>.06</td>
</tr>
<tr>
<td>Pre-test - the role of peers</td>
<td>.29***</td>
<td>.07</td>
<td>.17</td>
<td>.04</td>
<td>-.09</td>
</tr>
<tr>
<td>Pre-test - the role of evaluation</td>
<td>.16</td>
<td>.09</td>
<td>.37****</td>
<td>.30***</td>
<td>.13</td>
</tr>
<tr>
<td>Pre-test - the nature of knowledge</td>
<td>.36****</td>
<td>.25**</td>
<td>.26**</td>
<td>.13</td>
<td>.26**</td>
</tr>
</tbody>
</table>

*Note. N = 80.*

**p < .05. ***p < .01. ****p < .001.*
Table 15

**Pre-test to Follow-Up** Correlations among the Five Epistemological Reflection Domains

<table>
<thead>
<tr>
<th>Domain</th>
<th>Follow-up learner</th>
<th>Follow-up instructor</th>
<th>Follow-up peers</th>
<th>Follow-up evaluation</th>
<th>Follow-up knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test - the role of the learner</td>
<td>.46****</td>
<td>.40****</td>
<td>.43****</td>
<td>.21*</td>
<td>.15</td>
</tr>
<tr>
<td>Pre-test - the role of the instructor</td>
<td>.36***</td>
<td>.28**</td>
<td>.36***</td>
<td>.21*</td>
<td>.29***</td>
</tr>
<tr>
<td>Pre-test - the role of peers</td>
<td>.18</td>
<td>.31***</td>
<td>.31***</td>
<td>.02</td>
<td>.16</td>
</tr>
<tr>
<td>Pre-test - the role of evaluation</td>
<td>.43****</td>
<td>.25**</td>
<td>.21*</td>
<td>.45****</td>
<td>.25**</td>
</tr>
<tr>
<td>Pre-test - the nature of knowledge</td>
<td>.43****</td>
<td>.27**</td>
<td>.36***</td>
<td>.32***</td>
<td>.14</td>
</tr>
</tbody>
</table>

*Note. N = 74.*

*p < .10.  **p < .05.  ***p < .01.  ****p < .001.
Table 16

Post-Test to Follow-Up Correlations among the Five Epistemological Reflection Domains

<table>
<thead>
<tr>
<th>Domain</th>
<th>Follow-up learner</th>
<th>Follow-up instructor</th>
<th>Follow-up peers</th>
<th>Follow-up evaluation</th>
<th>Follow-up knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test - the role of the learner</td>
<td>.60****</td>
<td>.35***</td>
<td>.47****</td>
<td>.30***</td>
<td>.09</td>
</tr>
<tr>
<td>Post-test - the role of the instructor</td>
<td>.32***</td>
<td>.23**</td>
<td>.21*</td>
<td>.21*</td>
<td>.14</td>
</tr>
<tr>
<td>Post-test - the role of peers</td>
<td>.48****</td>
<td>.29**</td>
<td>.37****</td>
<td>.30***</td>
<td>.12</td>
</tr>
<tr>
<td>Post-test - the role of evaluation</td>
<td>.27**</td>
<td>.24**</td>
<td>.02</td>
<td>.39****</td>
<td>.06</td>
</tr>
<tr>
<td>Post-test - the nature of knowledge</td>
<td>.14</td>
<td>.21*</td>
<td>.08</td>
<td>.27**</td>
<td>.28**</td>
</tr>
</tbody>
</table>

Note. $N = 72$

*p < .10. **p < .05. ***p < .01. ****p < .001.
Table 17
Hierarchical Multiple Regression Model Testing Whether Intersubjectivity is a Moderator of Post-Test Epistemological Development

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SEB</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>.402</td>
<td>.097</td>
<td>.515****</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>.381</td>
<td>.099</td>
<td>.487****</td>
</tr>
<tr>
<td>Mean intersubjectivity</td>
<td>.030</td>
<td>.029</td>
<td>.131</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>.381</td>
<td>.100</td>
<td>.487****</td>
</tr>
<tr>
<td>Mean intersubjectivity</td>
<td>.095</td>
<td>.397</td>
<td>.417</td>
</tr>
<tr>
<td>Pre-test x Intersubjectivity</td>
<td>-.021</td>
<td>.129</td>
<td>-.287</td>
</tr>
</tbody>
</table>

Note. N = 50. $R^2 = .265$ for Step 1 ($p < .001$); Change in $R^2 = .016$ for Step 2 ($p = .307$); Change in $R^2 = .000$ for Step 3 ($p = .870$).

****$p < .001$. 

Note.
Table 18
Hierarchical Multiple Regression Model Testing Whether Intersubjectivity is a Moderator of Follow-Up Epistemological Development

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>$SE_B$</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>2.547</td>
<td>.304</td>
<td>.781****</td>
</tr>
<tr>
<td>Mean intersubjectivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>2.532</td>
<td>.319</td>
<td>.776****</td>
</tr>
<tr>
<td>Mean intersubjectivity</td>
<td>.004</td>
<td>.025</td>
<td>.017</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>2.512</td>
<td>.308</td>
<td>.770****</td>
</tr>
<tr>
<td>Mean intersubjectivity</td>
<td>-.008</td>
<td>.025</td>
<td>-.030</td>
</tr>
<tr>
<td>Pre-test x Intersubjectivity</td>
<td>-.732</td>
<td>.357</td>
<td>-.192**</td>
</tr>
</tbody>
</table>

Note. $N = 47$. $R^2 = .610$ for Step 1 ($p < .001$); Change in $R^2 = .000$ for Step 2 ($p = .863$); Change in $R^2 = .035$ for Step 3 ($p < .05$).

**$p < .05$. ****$p < .001$. **
Table 19

Hierarchical Multiple Regression Model Testing Whether Metacognitive Awareness is a Moderator of Post-Test Epistemological Development

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>1.296</td>
<td>.245</td>
<td>.514****</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>1.284</td>
<td>.246</td>
<td>.509****</td>
</tr>
<tr>
<td>Metacognitive awareness</td>
<td>.001</td>
<td>.001</td>
<td>.066</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>1.302</td>
<td>.258</td>
<td>.517****</td>
</tr>
<tr>
<td>Metacognitive awareness</td>
<td>.001</td>
<td>.001</td>
<td>.068</td>
</tr>
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<td>Pre-test x Metacognitive awareness</td>
<td>-.006</td>
<td>.023</td>
<td>-.025</td>
</tr>
</tbody>
</table>

Note. N = 80. R² = .264 for Step 1 (p < .001); Change in R² = .004 for Step 2 (p = .503); Change in R² = .001 for Step 3 (p = .809). ****p < .001.
Table 20
Hierarchical Multiple Regression Model Testing Whether Metacognitive Awareness is a Moderator of Follow-Up Epistemological Development

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
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<tr>
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<td>2.492</td>
<td>.307</td>
<td>.697***</td>
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<tr>
<td>Pre-test epistemological reflection</td>
<td>2.483</td>
<td>.310</td>
<td>.694****</td>
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<td>.007</td>
<td>.022</td>
<td>.028</td>
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<td>Step 3</td>
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<tr>
<td>Pre-test epistemological reflection</td>
<td>2.514</td>
<td>.335</td>
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<td>.027</td>
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<td>.372</td>
<td>-.024</td>
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</table>

*Note. N = 72. R² = .485 for Step 1 (p < .001); Change in R² = .001 for Step 2 (p = .749); Change in R² = .000 for Step 3 (p = .798).***p < .001.
### Table 21
Hierarchical Multiple Regression Model Exploring Whether Metacognitive Awareness is a Moderator of Post-Test Epistemological Development by Condition

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>$SE_B$</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
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<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>1.296</td>
<td>.245</td>
<td>.514****</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test epistemological reflection</td>
<td>1.295</td>
<td>.246</td>
<td>.514****</td>
</tr>
<tr>
<td>Condition</td>
<td>-.008</td>
<td>.020</td>
<td>-.036</td>
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<tr>
<td><strong>Step 3</strong></td>
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<td>.247</td>
<td>.508****</td>
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<td>Condition</td>
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<td>.021</td>
<td>-.055</td>
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<td>Metacognitive awareness</td>
<td>.001</td>
<td>.001</td>
<td>.079</td>
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<td>.249</td>
<td>.506****</td>
</tr>
<tr>
<td>Condition</td>
<td>-.012</td>
<td>.021</td>
<td>-.056</td>
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<td>Metacognitive awareness</td>
<td>.001</td>
<td>.001</td>
<td>.076</td>
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<tr>
<td>Pre-test x Condition</td>
<td>.123</td>
<td>.248</td>
<td>.049</td>
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<td><strong>Step 5</strong></td>
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<td>Pre-test epistemological reflection</td>
<td>1.306</td>
<td>.261</td>
<td>.518****</td>
</tr>
<tr>
<td>Condition</td>
<td>-.012</td>
<td>.021</td>
<td>-.057</td>
</tr>
<tr>
<td>Metacognitive awareness</td>
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<td>.001</td>
<td>.083</td>
</tr>
<tr>
<td>Pre-test x Condition</td>
<td>.148</td>
<td>.258</td>
<td>.059</td>
</tr>
<tr>
<td>Pre-test x Metacog awareness</td>
<td>-.009</td>
<td>.024</td>
<td>-.042</td>
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### Step 6

<p>| | | | |</p>
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</thead>
<tbody>
<tr>
<td>Pre-test epistemological reflection</td>
<td>1.308</td>
<td>.262</td>
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### Step 7

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*Note. N = 80. R² = .264 for Step 1 (p < .001); Change in R² = .001 for Step 2 (p = .714); Change in R² = .006 for Step 3 (p = .436); Change in R² = .002 for Step 4 (p = .623); Change in R² = .002 for Step 5 (p = .696); Change in R² = .003 for Step 6 (p = .588); Change in R² = .000 for Step 7 (p = .907).****p < .001.*
Table 22

Hierarchical Multiple Regression Model Exploring Whether Metacognitive Awareness is a Moderator of Follow-Up Epistemological Development by Condition

<table>
<thead>
<tr>
<th>Variable</th>
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Step 6

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Step 7

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<td>Pre-test x Cond x Metacog</td>
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Note. N = 72. R² = .485 for Step 1 (p < .001); Change in R² = .013 for Step 2 (p = .181); Change in R² = .000 for Step 3 (p = .941); Change in R² = .002 for Step 4 (p = .597); Change in R² = .001 for Step 5 (p = .783); Change in R² = .029 for Step 6 (p < .05); Change in R² = .002 for Step 7 (p = .580).

*p < .10. **p < .05. ****p < .001.
Figure 1. Change in Epistemological Reflection by Condition

- **Control**
- **Treatment**
Figure 2. Moderating Effect of Intersubjectivity

Follow-Up Epistemological Reflection

- --- Non-Acceptors
- - - Acceptors

Low Pre-Test | High Pre-Test

3.45
3.40
3.35
3.30
3.25
3.20
Figure 3. Moderating Effect of Metacognitive Awareness by Condition
Appendix A

Cognitive Development Intervention Session Six

The Effects of Chemical Additives on Foods

Script for Directions

During this session we will be talking about an issue which is of general concern and about which most people are at least vaguely familiar. I am not concerned with how much information you have about the issue, but how you think about it. I will read a statement out loud while you follow along. After I finish reading the statement, I will give you a minute or so to think about the issue and a series of stages of thinking, and then we will talk. In order to standardize what we talk about to match the other Paladins groups, I will ask a specific series of questions to direct the conversation. We encourage you to make this discussion a conversation, so please answer the questions by telling each other what your answers are. Throughout the conversation feel free to disagree with each other (for example, offer explanations, constructively criticize each other, defend your opinions, question each other, dispute disagreements openly, and state any inferences you may draw through this discussion). Keep in mind that the goal, by the end of our discussion, is that all of you will reach agreement on the most complex point of view to take in thinking about the issue. Are there any questions before we begin?

Description of Stages


Dilemma about the Effects of Chemical Additives on Foods

The following dilemma will be read aloud while participants read along:

There have been frequent reports about the relationship between chemicals that are added to foods and the safety of these foods.

Some studies indicate that such chemicals can cause cancer, making these foods unsafe to eat. Other studies, however, show that chemical additives are not harmful, and actually make the foods containing them more safe to eat.

Discussion of the Dilemma and Stages

Participants will be invited to think for a few minutes about the dilemma in conjunction with the most complex King and Kitchener (2002) stage they can understand. Next, every participant, in turn, will state and try to justify the most complex stage of thinking s/he understands, as it applies to the dilemma by answering the first standard probe question. The discussion will then be opened up and structured by the rest of the probe questions.
Seven Standard Prototypic Probe Questions

1. What is the most complex way you can think about these statements?
2. How did you come to form that point of view?
3. On what do you base that point of view?
4. To what extent, based on the most complex way you can think, do you believe that we can ever know for sure about this issue? How or why not?
5. When two people differ about matters such as this, is it the case, based on the most complex way you can think, that one opinion is right and one is wrong? (If the answer is yes ask “What do you mean by right?” If the answer is no ask, “Can you say that one opinion is in some way better than the other? And What do you mean by “Better”?”)
6. How is it possible, based on the most complex way you can think, that people have such different points of view about this subject?
7. How is it possible, based on the most complex way you can think, that experts in the field disagree about this subject?

Reaching Agreement

Discussion will conclude with the following question:
Now, can you all agree on the most complex point of view to take in thinking about this subject? Talk and then tell us what you all have decided. Use the stage descriptions to agree on the stage and tell us that stage and its corresponding number; restate this dilemma in terms of that stage and in contrast to the adjacent stages.

Evaluation Forms and Intersubjectivity Questions

After agreement is reached, participants will complete the pencil-and-paper evaluation of the session and facilitators’ fidelity to the structure of the discussion, the process evaluation form, and the two self-report intersubjectivity items.

Handout with Statements

Upon completion of the evaluation, participants will be presented with the following concrete prototypic summary statements about the effect of chemical additives on foods, from each of King and Kitchener’s (2002) stages. Participants will be encouraged to take these statements with them, discuss them with others, and practice the arguments with peers between sessions.

Stage One: My parents always bought all kinds of foods and none of us ever got sick or cancer, so I have to believe those foods with chemical additives are not harmful, they’re safe.

Stage Two: Some people believe that the chemicals cause cancer and that’s the way they want to believe. But I would never believe that because we eat them and we don’t all get cancer. Nobody could talk me out of thinking they are safe because I believe if they are on store shelves for us to buy, they have to be safe. I think the cancer-causing view is wrong.
Stage Three: I say some people may believe one thing based on their information about chemicals and cancer and I will get my information and we will compare notes and see what comes out. Then, I will believe one view depending on whatever seems more true or looks to have more evidence in its favor. In the mean time, I will believe they do, based on my information.

Stage Four: I'd be more inclined to believe the additives cause cancer if they ever had all the proof. It’s just like creation versus evolution. I wonder if we’ll ever know. People will come up with different interpretations because people differ. Who are you going to ask? Because no one was there. It’s up to the individual to decide.

Stage Five: I am from the perspective that chemicals in foods cause cancer, but we can never know without a doubt. There is evidence on both sides of the issue. On the one hand, there is evidence relating certain chemicals to cancer, and on the other hand there is evidence that certain chemicals in foods prevent things like food poisoning. People look at the evidence differently because of their own perspective, so what they conclude is relative to their perspective.

Stage Six: The thing is, I’m much more inclined to come down on the side that additives may cause cancer because there seems to be stronger research and evidence for this argument. But, it’s really important to keep in mind the facts researchers view as important, that they select out from other facts as being important, means that scientists have made some subjective choices about the effects of chemicals. And from there, selecting even minor facts that go into scientific reports involves some kind of subjective choices. So, I qualify my answer, because I don’t think that there can be anything approaching objective results about this topic.

Stage Seven: I don’t know whether or not we could say we know for sure about additives because the view that chemical additives cause cancer is very far along the continuum of what is probable. I can say that right and wrong are not comfortable categories to assign to this kind of issue. It’s more or less likely or reasonable, more or less in keeping with what the facts seem to be. It’s my belief that you have to be very skeptical about what you read.

Note: Directions were adapted from King & Kitchener (2002); stages and dilemmas were taken directly from King & Kitchener (2002); probe questions were adapted from King & Kitchener (2002) and Kitchener, Lynch, Fischer, & Wood (1993); prototypic summary statements were adapted from King & Kitchener (2002), Kitchener & King (1981), and Kitchener, Lynch, Fischer, & Wood (1993).
Appendix A, continued

Cognitive Development Intervention Session Seven

The Construction of the Pyramids

Script for Directions
During this session we will be talking about an issue which is of general concern and about which most people are at least vaguely familiar. I am not concerned with how much information you have about the issue, but how you think about it. I will read a statement out loud while you follow along. After I finish reading the statement, I will give you a minute or so to think about the issue and a series of stages of thinking, and then we will talk. In order to standardize what we talk about to match the other Paladins groups, I will ask a specific series of questions to direct the conversation. We encourage you to make this discussion a conversation, so please answer the questions by telling each other what your answers are. Throughout the conversation feel free to disagree with each other (for example, offer explanations, constructively criticize each other, defend your opinions, question each other, dispute disagreements openly, and state any inferences you may draw through this discussion). Keep in mind that the goal, by the end of our discussion, is that all of you will reach agreement on the most complex point of view to take in thinking about the issue. Are there any questions before we begin?

Description of Stages

Dilemma about the Construction of the Pyramids
The following dilemma will be read aloud while participants read along:

Most historians claim that the pyramids were built as tombs for kings by the ancient Egyptians, using human labor, and aided by ropes, pulleys, and rollers. Others have suggested that the Egyptians could not have built such huge structures by themselves, for they had neither the mathematical knowledge, the necessary tools, nor an adequate source of power.

Discussion of the Dilemma and Stages
Participants will be invited to think for a few minutes about the dilemma in conjunction with the most complex King and Kitchener (2002) stage they can understand. Next, every participant, in turn, will state and try to justify the most complex stage of thinking s/he understands, as it applies to the dilemma by answering the first standard probe question. The discussion will then be opened up and structured by the rest of the probe questions.
Seven Standard Prototypic Probe Questions
1. What is the most complex way you can think about these statements?
2. How did you come to form that point of view?
3. On what do you base that point of view?
4. To what extent, based on the most complex way you can think, do you believe that we can ever know for sure about this issue? How or why not?
5. When two people differ about matters such as this, is it the case, based on the most complex way you can think, that one opinion is right and one is wrong? (If the answer is yes ask “What do you mean by right?” If the answer is no ask, “Can you say that one opinion is in some way better than the other? And What do you mean by “better”??”)
6. How is it possible, based on the most complex way you can think, that people have such different points of view about this subject?
7. How is it possible, based on the most complex way you can think, that experts in the field disagree about this subject?

Reaching Agreement
Discussion will conclude with the following question:
Now, can you all agree on the most complex point of view to take in thinking about this subject? Talk and then tell us what you all have decided. Use the stage descriptions to agree on the stage and tell us that stage and its corresponding number; restate this dilemma in terms of that stage and in contrast to the adjacent stages.

Evaluation Forms and Intersubjectivity Questions
After agreement is reached, participants will complete the pencil-and-paper evaluation of the session and facilitators' fidelity to the structure of the discussion, the process evaluation form, and the two self-report intersubjectivity items.

Handout with Statements
Upon completion of the evaluation, participants will be presented with the following concrete prototypic summary statements about the construction of the pyramids from each of King and Kitchener's (2002) stages. Participants will be encouraged to take these statements with them, discuss them with others, and practice the arguments with peers between sessions.

Stage One: Somebody had to build them, so I have to believe historians that they were built as tombs for kings by the ancient Egyptians.

Stage Two: Some people believe that the Egyptians could not build the pyramids and that's what they want to believe. But I would never believe that because people have found mummies in the pyramids, so they must be tombs. Nobody could talk me out of thinking they were built by the Egyptians to be tombs because experts know the mummies in them were kings and I believe the experts who say ancient people had the right kinds of tools. I think the view that Egyptians built them is right.
Stage Three: I say some people may believe they weren’t built by Egyptians based on their information and I will get my information and we will compare notes and see what comes out. Then, I will believe one view depending on whatever seems more true or looks to have more evidence in its favor. In the mean time, I will believe they were, based on my information.

Stage Four: I’d be more inclined to believe they built the pyramids if they ever had all the proof. It’s just like creation versus evolution. I wonder if we’ll ever know. People will come up with different interpretations because people differ. Who are you going to ask? Because no one was there. It’s up to the individual to decide.

Stage Five: I am from the perspective that the Egyptians could not build the pyramids, but we can never know without a doubt. There is evidence on both sides of the issue. On the one hand, there is evidence proving that they couldn’t possibly build such large structures, and on the other hand there is evidence that people in ancient times could and they built burial tombs for royalty. People look at the evidence differently because of their own perspective, so what they conclude is related to the perspective they have. (klfw)

Stage Six: The thing is, I’m much more inclined to come down on the side that the Egyptians built them because there seems to be stronger research and evidence for this argument. But, it’s really important to keep in mind the facts researchers view as important, that they select out from other facts as being important, means that scientists have made some subjective choices about whether or not they built them. And from there, selecting even minor facts that go into scientific reports involves some kind of subjective choices. So, I qualify my answer, because I don’t think that there can be anything approaching objective results about this topic.

Stage Seven: I don’t know whether or not we could say we know for sure about the pyramids because the view that the Egyptians built the pyramids is very far along the continuum of what is probable. I can say that right and wrong are not comfortable categories to assign to this kind of issue. It’s more or less likely or reasonable, more or less in keeping with what the facts seem to be. It’s my belief that you have to be very skeptical about what you read.

Note: Directions were adapted from King & Kitchener (2002); stages and dilemmas were taken directly from King & Kitchener (2002); probe questions were adapted from King & Kitchener (2002) and Kitchener, Lynch, Fischer, & Wood (1993); prototypic summary statements were adapted from King & Kitchener (2002), Kitchener & King (1981), and Kitchener, Lynch, Fischer, & Wood (1993).
Appendix B

Ethnicity

Ethnicity (please check all that apply):

HISPANIC OR LATINO
☐ Mexican or Chicano
☐ Central or South American
☐ Puerto Rican
☐ Cuban
☐ Dominican
☐ Other __________________________

NATIVE AMERICAN
☐ American Indian or Alaskan Native
☐ Hawaiian Native
☐ Tribal Affiliation __________________________

BLACK
☐ African American
☐ African
☐ West Indian
☐ Haitian
☐ Other __________________________

ASIAN AMERICAN OR ASIAN
☐ Chinese
☐ Japanese
☐ Korean
☐ Pacific Islander or Filipino
☐ South Asian (Indian, Pakistani, Sri Lankan)
☐ Southeast Asian
☐ Other __________________________

CAUCASIAN OR WHITE (A person having origins in any of the original peoples of Europe or the Middle East.)
☐

OTHER
☐ Please specify origin __________________________

Were you born in the United States (please circle one)? yes no
Appendix C

The Measure of Epistemological Development

INSTRUCTIONS:

The questionnaire that follows has to do with your perspective on learning. Each of the questions on the following pages asks for your opinion or choice on a given subject, and the REASONS why you have that particular perspective or opinion. We are interested in understanding your perspective as fully as possible. Please try to help us understand your thinking by answering all the questions below and GIVING AS MUCH DETAIL AS YOU CAN TO DESCRIBE HOW YOU FEEL ABOUT EACH QUESTION – EVEN IF YOU HAVE TO WRITE OUT YOUR EXPLANATIONS MORE THAN ONCE. Don’t just write “same as before” after a question. If you can explain better or use different words to show what you mean, that helps us even more. Feel free to use the backs of pages if you need more space. Thank you.
Do you learn best in classes which focus on factual information or classes which focus on ideas and concepts?

Why do you learn best in the type of class you chose above?

What do you see as the advantages of the choice you made above?

What do you see as the disadvantages of the choice you made above?

If you could give advice to anyone on how best to succeed in college coursework, what kind of advice would you give them? Talk about what you believe is the key to doing well in college courses?
During the course of your studies, you have probably had teachers with different teaching methods (lectures or discussions, activities or individual work, fast-paced or slow-paced, etc.). As you think back to teachers you have had, describe in detail the method of teaching which had the most beneficial effect on you.

What made that teaching method beneficial? Please be specific and use examples.

Were there aspects of that teaching method which were not beneficial? If so, please talk about some of the aspects and why they were not beneficial.

What are the most important things you learned from the teacher’s method of teaching?

Please describe the type of relationships with teachers that would help you to learn best (unfamiliar, only see them in class, talk outside of class, personal contact, very familiar, frequently have discussions, etc.) and explain why.
Do you prefer classes in which the students do a lot of talking, or where students don’t talk very much?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Why do you prefer the degree of student involvement/participation that you chose above?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What do you see as the advantages of your preference above?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What do you see as the disadvantages of your preference?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What type of interactions would you like to see among members of a class in order to enhance your own learning?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Some people think that hard work and effort will result in high grades in school. Others think that hard work and effort are not a basis for high grades. Which of these statements is most like your own opinion?

________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________________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Sometimes different teachers give different explanations for historical events or scientific phenomena. When two teachers explain the same thing differently, can one be more correct than the other?

When two explanations are given for the same situation, how would you go about deciding which explanation to believe? Please give details and examples.

Can one ever be sure of which explanation to believe? If so, how?

If one can't be sure of which explanation to believe, why not?
Appendix D

Intersubjectivity Items

**Exposure to Reasoning**
To what extent do you think you were exposed to different reasoning (that is, different explanations and arguments for ideas) by any other person during this session? For example, different rationales, logic, bases for points of view, etc.?

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**Adopted Reasoning**
To what extent do you think you would be able to use that reasoning (explanations, arguments, rationales, etc.) on your own in another discussion after this session?

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Appendix E

Intersubjective Milieu/Conditions for Intersubjectivity

To what extent were you engaged in a discussion with peers?

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not at all

To what extent was there discussion that pertained to the topic at-hand?

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not at all

To what extent were there different points of view?

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not at all

To what extent was there a balance in disagreement during the session, that is, the conversation had some disagreement but not too much?

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not at all

To what extent did you feel as though you could be open and willing to disagree?

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not at all

To what extent do you think people in the discussion were able to make propositions, defend their opinions, dispute arguments, and ask questions during the discussion?

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not at all
Appendix F

Metacognitive Awareness, Regulation of Cognition Sub-Scale

The next set of questions are about your knowledge about learning. Read each one and decide how well it applies to you. For each item, record your rating in the space next to that item.

1. 10
   doesn’t apply to me at all            applies very closely to me

1. ___ I ask myself periodically if I am meeting my goals.
2. ___ I consider several alternatives to a problem before I answer.
3. ___ I pace myself while learning in order to have enough time.
4. ___ I think about what I really need to learn before I begin a task.
5. ___ I know how well I did once I finish a test.
6. ___ I set specific goals before I begin a task.
7. ___ I slow down when I encounter important information.
8. ___ I ask myself if I have considered all options when solving a problem.
9. ___ I consciously focus my attention on important information.
10. ___ I ask myself if there was an easier way to do things after I finish a task.
11. ___ I periodically review to help me understand important relationships between concepts.
12. ___ I ask myself questions about the material before I begin.
13. ___ I think of several ways to solve a problem and choose the best one.
15. ___ I ask others for help when I don’t understand something.
16. ___ I find myself analyzing the usefulness of strategies while I study.
17. ___ I focus on the meaning and significance of new information.
18. ___ I create my own examples to make information more meaningful.
19. ___ I find myself pausing regularly to check my comprehension.
20. ___ I ask myself how well I accomplished my goals once I’m finished.
21. ___ I draw pictures or diagrams to help me understand while learning.
22. ___ I ask myself if I have considered all options after I solve a problem.
23. ___ I try to translate new information into my own words.
24. ___ I change strategies when I fail to understand.
25. ___ I use the organizational structure of the text to help me learn.
26. ___ I read instructions carefully before I begin a task.
27. ___ I ask myself if what I’m reading is related to what I already know.
28. ___ I reevaluate my assumptions when I get confused.
29. ___ I organize my time to best accomplish my goals.
30. ___ I try to break studying down into smaller steps.
31. ___ I focus on overall meaning rather than specifics.
32. ___ I ask myself questions about how well I am doing while I am learning something new.
33. ___ I ask myself if I learned as much as I could have once I finish a task.
34. ___ I stop and go back over new information that is not clear.
35. ___ I stop and reread when I get confused.
<table>
<thead>
<tr>
<th>POSITION</th>
<th>View of Knowledge</th>
<th>Role of Authority</th>
<th>Role of Learners/Peers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2: Dualism</td>
<td>focus on facts/content—What to learn</td>
<td>• sees Authority (teacher, textbook) as sole source of Truth</td>
<td>• responsibility = reproducing correct information</td>
</tr>
<tr>
<td></td>
<td>emphasis on right answers, not methods to find answers</td>
<td>• differentiates good from bad Authorities</td>
<td>• sees self as passive receiver of knowledge</td>
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<tr>
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<td>learning = information exchange</td>
<td>• expects teacher as Authority to be responsible for the learning</td>
<td>• minimal self-awareness</td>
</tr>
<tr>
<td>3: Early Multiplicity</td>
<td>emphasis on methods for finding answers—How to learn</td>
<td>• sees new roles for teacher (Authority)—friend, advisor</td>
<td>• peers may be noted as part of classroom environment (i.e., friends in class)</td>
</tr>
<tr>
<td></td>
<td>• cites process as the way to learn</td>
<td>• looks to Authority for right methods</td>
<td>• responsibility = working hard, learning how to learn</td>
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<tr>
<td></td>
<td>• good learning is practical/relevant</td>
<td>• stresses relationship between teacher and students</td>
<td>• interested in variety of opinions, but still sees teacher as final authority</td>
</tr>
<tr>
<td>4: Late Multiplicity</td>
<td>emphasis on how to think</td>
<td>• begins to assert independence from authority—often discounts expertise</td>
<td>• displays some ownership of thinking, personal viewpoints</td>
</tr>
<tr>
<td></td>
<td>• sees independent thinking as way to find answers/solutions</td>
<td>• sees teacher as model for how to think</td>
<td>• responsibility = thinking independently, using supportive evidence</td>
</tr>
<tr>
<td></td>
<td>• begins to see difference between opinion and supported opinion</td>
<td>• may define dependence on authority as “New Truth”</td>
<td>• increasing ownership of ideas</td>
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<td>• more actively involved in learning process</td>
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<tr>
<td>5: Contextual Relativism</td>
<td>emphasis on how to think in context</td>
<td>teacher a guide, facilitator</td>
<td>• peers legitimate source of learning</td>
</tr>
<tr>
<td></td>
<td>• knowledge disconnected from absolutes</td>
<td>teacher has appropriate expertise to critique/evaluate</td>
<td>• responsibility = seeking/creating knowledge, taking learning seriously</td>
</tr>
<tr>
<td></td>
<td>• strives for expertise</td>
<td>seeks a learning partnership with teacher</td>
<td>• very active agent in own learning; internally motivated</td>
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<td>• genuine empathy becomes possible</td>
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<td></td>
<td>• peers’ perspectives are legitimate to the extent they use adequate supportive evidence</td>
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</tbody>
</table>

Originally developed by the University of Maryland Perry Rating Group (Peggy Fitch, L. Lee Knefelkamp, William Moore, & Kathe Taylor) & the staff of the Alverno College Office of Research and Evaluation (Judy Reisetter Hart, Marcia Mentkowski, Bill Rickards & Glen Rogers), 1978-1983
<table>
<thead>
<tr>
<th>POSITION 2: Dualism</th>
<th>Classroom Atmosphere</th>
<th>Role of Evaluation</th>
<th>Language</th>
<th>Multiples/Quantity</th>
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<tbody>
<tr>
<td>focuses more on physical environment of classroom than on learning</td>
<td>expects clear, straightforward approach—teacher should test what has been taught</td>
<td>uses absolutes (all, none) and/or dichotomies (either/or)</td>
<td>multiples, if evident, tend to be simplistic and content-oriented</td>
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<tr>
<td>expects/prefers a structured, traditional formal process</td>
<td>evaluation should emphasize right answers</td>
<td>makes statements in the form of rules</td>
<td>simplistic</td>
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<td>emphasis on “fun” in class</td>
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<tr>
<td>POSITION 3: Early Multiplicity</td>
<td>Classroom Atmosphere</td>
<td>Role of Evaluation</td>
<td>Language</td>
<td>Multiples/Quantity</td>
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<tr>
<td>endorses a variety of teaching methods</td>
<td>emphasizes fairness in evaluation procedures</td>
<td>uses quantity terms, qualifiers, showing a break with absolutes</td>
<td>makes simple lists of multiples</td>
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<tr>
<td>enjoys challenge</td>
<td>believes quantity of effort should correlate directly with success (hard work = good grades)</td>
<td>uses vague, unspecific terms (fuzzy)</td>
<td>“corrals” multiple non-parallel items</td>
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<tr>
<td>begins to accept less structured learning processes (may react against “facts,” memorization)</td>
<td>essay exams good because you can write more</td>
<td>shows some difficulty in making connections, transitions in ideas</td>
<td>provides specific, concrete details</td>
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</tr>
<tr>
<td>POSITION 4: Late Multiplicity</td>
<td>Classroom Atmosphere</td>
<td>Role of Evaluation</td>
<td>Language</td>
<td>Multiples/Quantity</td>
</tr>
<tr>
<td>endorses greater flexibility, greater student responsibility for learning environment</td>
<td>questions authority’s right to evaluate</td>
<td>uses absolutes within a multiplicitic framework</td>
<td>comfortable with a diversity of ideas</td>
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<tr>
<td>rejects rote learning, “regurgitation”</td>
<td>begins to accept qualitative criteria as legitimate in evaluation</td>
<td>assigns new rules (must, should) within multiplicity</td>
<td>quality and quantity are both important</td>
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<tr>
<td>enjoys assignments that require analysis, synthesis</td>
<td>essay exams acceptable because they can reflect one’s thinking better</td>
<td>uses “buzz” words with some elaboration</td>
<td>begins to integrate multiples</td>
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<td>begins thinking about own thinking, but often unaware of own contradictions</td>
<td>presents lists with elaboration</td>
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<tr>
<td>POSITION 5: Contextual Relativism</td>
<td>Classroom Atmosphere</td>
<td>Role of Evaluation</td>
<td>Language</td>
<td>Multiples/Quantity</td>
</tr>
<tr>
<td>values intellectual dialogue, endorses seminar format</td>
<td>separates evaluation of work from evaluation of self; comfortable with criticism</td>
<td>increasing emphasis on meta-thought</td>
<td>multiplicity/diversity is assumed</td>
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<tr>
<td>expects critique of own arguments, viewpoints</td>
<td>seeks/values quality feedback</td>
<td>presents clear critiques with both positives and negatives</td>
<td>presents variety of alternative perspectives (“on the other hand”)</td>
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<tr>
<td>mentions joy in learning, excitement of ideas</td>
<td>connects thoughtful critique with caring</td>
<td>synthesizes perspectives into coherent theme/s</td>
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</table>

Originally developed by the University of Maryland Perry Rating Group (Peggy Fitch, L. Lee Knefelkamp, William Moore, & Kathe Taylor) & the staff of the Alverno College Office of Research and Evaluation (Judy Reisetter Hart, Marcia Mentkowski, Bill Rickards & Glen Rogers), 1978-1983
Human subjects approval for this activity expires on the date indicated above. Depending upon the activity status of the project, attachments may be required. Refer to IRB website (www.irb.arizona.edu) for detailed instructions. **Note:** If renewal is not granted before the expiration date, all study activities must stop at that time. If study procedures/treatment must be continued for subject safety, contact the IRB office immediately.

**Activity Status – check one box only**
- Category A: attach items 1-13 listed on reverse
- Category B: attach items 1-12 listed on reverse
- Category C: attach items 1-8 listed on reverse
- Category D: no attachments required; complete and submit this form only

**Subject Numbers (local enrollment)**
If more than one study population is involved, report enrollment under number 2 of checklist (see reverse)
- Number of new subjects enrolled (consented) since last reporting period
- Total number of subjects enrolled (consented) since start of project
- Male/female ratio of total enrolled since start of project

**Conflict of Interest Statement (COI):** see COI policies at http://vpr2.admin.arizona.edu/rie/conflict_of_interest.htm
- Do any of the investigators serve as a speaker or consultant to the sponsor, the manufacturer, or the owner of the test article? □ Yes □ No
- Do any of the investigators (or their family members) derive a direct or indirect benefit equity and/or royalty relationship with the sponsor, manufacturer, or owner of the test article? □ Yes □ No

I certify that this research will be conducted in accordance with the currently approved protocol/amendments and that no changes to procedures or study documents will be made without the knowledge/approval of the IRB.

```
Signature of Principal Investigator: Patricin MacCormack  9/25/03
Date: 9/25/03

Signature of Departmental Review Chair: Patricin MacCormack  9/25/03
Date (not required for concluded or not begun studies)
```

**FOR COMMITTEE USE ONLY**
- Approve □ Disapprove □ Period of Approval: OCT 07 2003 OCT 07 2004
- Approval for ABOK grant proposal which allows for addition of faculty mentorship component, revised consent form, demographic form, and personnel changes granted concurrently with project re-approval. Study status remains "closed to new subjects" pending additional funding. Prior to continuing enrollment, notify Committee of confirmed funding and any additional protocol changes.
- Theodore J. Glattke, Ph.D., Chair  Date Reviewed: OCT 06 2003
- Social and Behavioral Sciences Committee  □ Expedited Review □ Full Committee Review
References


King, P.M. & Kitchener, K.S. (2002). The reflective judgment model: Twenty years of research on epistemic cognition. In B.K. Hofer & P.R. Pintrich (Eds.), Personal epistemology: The psychology of beliefs about knowledge and knowing (pp. 37-61). Mahwah: Lawrence Erlbaum Associates.


