

Evaluating a Pedagogical Strategy to Address Misconceptions of Child Development

Robert S. Weisskirch, MSW, Ph.D., CFLE
Deanne R. Pérez-Granados, Ph.D.
California State University, Monterey Bay

ABSTRACT. Students often enter courses with prior knowledge that includes misconceptions about human development and behavior. Generally, curriculum is constructed to present research-based information that may serve to ameliorate these misconceptions. However, these misconceptions persist, which may require more direct intervention. In this study, we investigated a pedagogical approach in which students directly read and write about common misconceptions to see if this approach addresses their misconceptions and changes their understanding. In total, 75 undergraduate (females = 64, males = 11) students participated in the study, with 34 students in the experimental group and 41 students in the control group. Using a repeated-measures ANOVA, there were few significant changes in the students' ratings of the truthfulness of the misconceptions. Revisions to the pedagogical approach examined in this study are suggested to strengthen its effectiveness.

Students often come into courses on Human Development and Family Studies with some “truths” or “beliefs” about human behavior and development. It has been argued that human beings have natural capacities for developing early understandings within core domains of knowledge (Keil, 2008), and from these core domains of knowledge they have developed “folk, naïve, lay, or commonsense theories” based on their everyday experiences and understandings (Wellman & Gelman, 1992, p. 338). One key aspect is folk psychology, which consists of predisposed understandings of self, other individuals, and social groups (Geary, 2008), which research suggests develops early in life (Miller & Aloise, 1989). These folk systems of knowledge can be fraught with misconceptions because they have “embodied biases and heuristics” that, on the one hand, allow humans to “easily process useful forms of information and act on that information,” but, on the other hand, can lead to the tendency to draw misleading conclusions that are based on intuitive understandings rather than careful study of scientific evidence (Keil, p. 197). Indeed, Swami, Steiger, Pietschnig, Nader, and Voracek (2012) found that belief in human-related myths was significantly associated with antiscientific attitudes. Kowalski and Taylor (2009) noted that many college students not only enter classrooms with a wide variety of misconceptions but also leave those classrooms with the same erroneous beliefs intact, as evidenced by the Introduction to Psychology students in their study.

Direct correspondence to Dr. Robert S. Weisskirch at rweisskirch@csumb.edu

In order to bring about the conceptual change necessary to overcome these misconceptions, one key strategy instructors use is the engagement of students in reading, lectures, and discussions to directly refute their misconceptions (Vaughan, 1977). To evoke conceptual change, some instructors may build curriculum to provide authoritative, evidence-based content, which may “correct” these perceived truths or beliefs. These perceived truths or beliefs may provide organic heuristics for understanding the world but may not be as functional in the face of academic tasks that focus on evidence-based argumentation rather than those that are experience-based or traditional beliefs. Geary (2008) argued that human beings have the ability to “inhibit folk systems and engage in controlled problem solving,” and an important role of educational institutions is to leverage these inhibition systems to override the intuitive folk systems that students have developed (p. 182). However, Keil (2008) counters this position, having argued that schooling is “surprisingly ineffective at overriding some of the outputs of folk systems” and suggested that

a primary goal of education is to generate explanatory gists that are at just the right level of detail, [and achieving this goal requires] knowing what students know, knowing what they could know after a reasonable period of instruction, and knowing what kinds of new knowledge would do them the most good at expanding their understanding of the world, enabling them to make informed decisions and more effective actions in relevant contexts. (p. 198)

Both Keil and Geary argued that students must have educational opportunities to examine the misconceptions that emerge from their folk understandings, and that either “controlled problem solving” (Geary) or “explanatory gists” (Keil) in educational contexts will allow students to incorporate newly learned evidence and information to correct their misconceptions. In this study, we examine the effectiveness of the pedagogical strategy of engaging students in the task of exploring their commonly held misconceptions (or myths) about human development by providing them with scientific evidence and explanations that question the beliefs that they hold as “truths” with the goal of revising and expanding their understanding of human development.

Using misconceptions embedded in students’ intuitive understanding as a pedagogical tool is a strategic teaching approach supported by Vygotsky’s “zone of proximal development [ZPD].” This “social situation of development” through which a teacher can carefully construct a learning activity that leads to a “structural reorganization of a child’s [in this case, students’] psychological functions” thus advances the student’s own thinking and problem-solving processes to promote learning (Chaiklin, 2003, pp. 47-48). Keil (2008) argued that instructors should view folk understandings as assets rather than limitations, suggesting that “formal education often needs to build on intuitive knowledge systems rather than inhibit them [in order to] help students appreciate the limits of their understanding, [and] to outsource understanding to other minds” (p. 196). However, when misconceptions persist, they may inhibit learning. For example, Arntzen and his colleagues found that even with formal training, psychology undergraduate students, masters’ students, and even college professors held misconceptions about psychological concepts relevant to behavioral analysis (Arntzen, Lokke, Lokke, &

Eilertsen, 2010). Misconceptions, therefore, can be resistant to change, even with the benefit of scientific knowledge.

Retaining misconceptions may hamper students' overall performance in a specific course (Kuhle, Barber, & Bristol, 2009), making addressing students' misconceptions an important and necessary teaching goal for educators. Counterattitudinal advocacy is a pedagogical strategy for advancing student thinking that provides students with the opportunity to argue their own opinions (Miller, Wozniak, Rust, Miller, & Slezak, 2002), and thus may decrease the number of misconceptions held. Guzzetti (2000) supported the approach of offering students an opportunity to read refutational text that addresses a misconception and refutes the misconception with information supporting the truth. Using refutational text has been found to be more effective than just using a standard text that does not address the misconception (Hynd, Alvermann, & Qian, 1997). Refutational text may be more likely to induce cognitive dissonance in students by challenging their existing beliefs or knowledge with discrepant information and evidence. Through cognitive dissonance, students actively try to make sense out of what is puzzling them. Jonassen and Land (2000) argued that learning is a process of meaning making, and this process involves "dissonance between what we know and what we want or need to know," thus pushing the learner to take ownership of his or her knowledge by actively constructing one's own understanding to resolve the puzzlement and perturbation experienced by cognitive dissonance (p. vi). Kowalski and Taylor (2004) noted that the greatest change in misconceptions for introductory psychology students took place when instructors targeted the preconceived notions that were incorrect, and then provided counterevidence to support the correct information.

In this study, instructors of an upper division human development course supplemented the course textbook with readings and written assignments using Mercer's (2010) *Child Development: Myths and Misunderstandings*. By offering students opportunities to reflect on, and question, common misconceptions of human development (some of which may be their own), and structuring opportunities to learn about evidence from the field of family science that contradicts those misconceptions, we hypothesized that these students would be more likely to revise their understandings than students in other human development classes who did not directly address myths and misunderstandings using a refutational text (i.e., Mercer's book).

Method

Participants enrolled in an upper-division Child Development course read and responded to critical thinking questions from selected "claims" from Mercer's (2010) *Child Development: Myths and Misunderstandings* three times throughout the semester. To assess changes, participants completed a paper-and-pencil questionnaire about the credibility of the claims at the beginning and at the conclusion of the semester. Students enrolled in courses on Cross-cultural Human Development, or Behavior Disorders of Childhood and Adolescence, served as controls completing the same questionnaire at the beginning and the end of the semester. Two waves of data were collected during the fall 2009 and spring 2010 semesters. In fall 2009, Dr. Pérez-Granados taught the experimental course with Dr. Weisskirch's similar course serving as control. The following semester, the situation was opposite; Students who were simultaneously enrolled in the experimental and control courses were dropped from the analyses. Since the book was new (with no previous edition), participants could not have had experience with the text in the past.

Myths Curriculum

Students in the experimental courses used a topically organized child and adolescent development textbook along with Mercer's *Child Development* book that contains 51 common—but inaccurate—claims about child development, such as “Having kids listen to Mozart makes them smart” with concomitant narrative literature review of the evidence of this claim. The claims are organized both topically across developmental domains and chronologically across developmental periods; for instance, the Mozart claim is listed topically under *cognitive development* and chronologically under *middle childhood*. See appendix for these items.

For their written assignments, students were given a selection of five claims in each developmental domain (physical, cognitive/language, socioemotional), and asked to choose one of the five claims to respond to in their papers. In their papers, students are asked to (a) summarize the claim, as well as Mercer's evidence and conclusions regarding the accuracy of the claim; (2) analyze the claim by addressing specific questions from the Mercer text and by the instructor, and making specific links to the relevant theory, concepts, and/or processes of development covered in the textbook, course lectures, and discussions; and (3) describe and explain how they would intervene to dispel or correct the myth in a parent education unit. Students wrote a total of three papers from each of the domains, with each one being three to four pages in length, double-spaced, using 12-point font and 1-inch margins.

In addition to the written assignments, the instructor and/or students would occasionally integrate specific claims into class discussions. For example, in a discussion of theories of language development, students often comment that they think parents who speak to their child using baby talk are not helping their kids learn language and may be making language development worse. This kind of comment is directly relevant to Claim 15 in the Mercer book (summarized as): “Parents should not talk baby talk to their children, because this slows their language development.” The instructor uses this comment as an opportunity to open up a discussion about the progression of language development (e.g., receptive language precedes expressive language), and the components of language that emerge more rapidly in the first year of life (e.g., phonology) versus the second year of life (e.g., semantics and syntax) that is found in the textbook. Or, during a discussion of brain development, the instructor may integrate the claim, “Young teenagers should be tried and sentenced as adults if they commit serious crimes,” into discussing development of the prefrontal cortex in adolescence.

The goal of integrating claims from Mercer's book into class readings, discussions, and written assignments is to give students the opportunity to actively question their erroneous assumptions about child development and family science, and use the information and evidence introduced in the class not only to “change their minds” about specific myths of child development but also to encourage them to engage in the practice of questioning their assumptions regularly and consistently throughout the course.

Participants

In total, 75 students participated in the study (females = 64, males = 11). Thirty-four participants (45%) were included in the experimental sample and 41 participants (55%) were included in control sample. Those who did not complete pretest and posttest measures were excluded from both samples. The ethnic composition of the sample was 51% Euroamerican, 40% Latino, 5% Mixed Race/Ethnicity, 4% Other (African American, Asian American, and/or American Indian). The majors of the total sample were 51% Liberal Studies (pre-Education), 32% Psychology, 4% Social and Behavioral Sciences, 4% Biology, 3% Kinesiology, and 6.5% Other. We collapsed major groups to Liberal Studies, Psychology, and Other in order to check for differences in majors between the experimental group and control group. Psychology students were more likely to be in the experimental group and Liberal Studies students were likely to be in the control group, $\chi^2(2) = 43.66, p < .001$. There were also more males in the experimental group than in the control group, $\chi^2(1) = 10.80, p < .01$. There were no differences by instructor or semester.

Measures

Demographics. Participants completed a demographic questionnaire that included their age; gender; ethnicity; major field of study; previous experience with Human Development, Family Studies, and/or Psychology courses; and typical grades earned.

Claims. Participants completed a 25-item measure specifically designed for this study. We used 25 of the 51 claims that Mercer (2010) elucidates in her text, *Child Development*, as items in the measure. Examples of some of the items (i.e., the titles as given by Mercer) are as follows: “babies cannot see when they are first born,” “vaccines are a cause of autism,” and “sugar is a major cause of hyperactive behavior.” Participants rated the credibility of each claim using the scale of 1 = definitely false to 6 = definitely true. Cronbach’s alpha was .64 for this scale.

Results

A repeated measures analysis of variance (ANOVA) was used to compare the experimental and comparison groups’ prescores and postscores of the claims measure. There was a significant interaction between prescores and postscores by group, $F(25, 43) = 1.94, p < .05, \eta^2 = .53$. See Table 1 for detail. There were no significant changes for any of the items just within the control group.

There were six claims that demonstrate significant changes in the experimental group in comparison to the control group. Unless noted, all of these claims were rated as less truthful at posttest. The following are these six claims (as items on the measure using Mercer’s summarizations):

1. As a mother-to-be gets closer to the date when her baby will be born, she needs to be more careful about alcohol and drugs because the risk of birth defects increases throughout pregnancy.

2. Parents need to have contact with their babies right after birth, so they can bond with them.
3. Babies are born with emotional attachment to their mothers and can recognize their mothers at once.
4. Parents should not talk baby talk to their children because this slows their language development.
5. Vaccines are a cause of autism. (Participants rated this more truthful at post-test.)
6. Young teenagers should be tried and sentenced as adults if they commit serious crimes.

Conclusions

Although there were overall significant differences between the samples that addressed the claims and those that did not, results indicate that there are few meaningful changes in beliefs. Interestingly, four of the six claims that showed significant differences were included in the 15 claims from which students selected to read and respond to in their paper assignments. These findings are consistent with Kowalski and Taylor (2009), who addressed misconceptions in an introductory psychology course using both refutational lectures and text, and compared this approach to (a) courses with refutational lectures and no text, and (b) courses with no lecture and refutational text. In their curriculum design, they supplemented the text with 38 refutational readings, of which 18 were covered by refutational lecture in class. While they found no significant difference in pre-gains to post-gains in student scores between the “refutational text and lecture” condition and the “refutational lecture with no text” condition, there were significant gains in scores for the “refutational text and lecture” condition compared to the “no lecture with refutational text” condition. They concluded that “instructors must specifically tell [students] that preconceived notions are incorrect and then immediately provide clear evidence demonstrating the correctness of the new information” (p. 157). Kowalski and Taylor do acknowledge, however, that there was no way to know whether students actually read the assigned refutational readings. Nonetheless, findings indicate that directly assigning the refutational writing may change their conceptual understanding.

In this study, providing supplementary refutational readings and requiring written assignments that addressed only three specific myths and misconceptions of human development may not be enough to change students’ folk understandings of human development. Nevertheless, it is encouraging that of the 6 claims that did show positive change, 4 were included in our selection list for written assignments. Most of the readings on the 50 claims were not assigned to students, nor were many of them specifically integrated into course lectures and discussions. Perhaps, there were simply too few opportunities for students to confront, reflect on, and question their inaccurate understandings of child development. Having the opportunity to summarize and address questions about specific claims in a written assignment may have helped students reflect on those specific misconceptions because, in their writing, they are actively engaged in their own learning through reflection and compository responses to questions.

Reading refutational text only may be too passive an activity to trigger the necessary cognitive dissonance in students’ thinking to engage them in the active “meaning making” that Jonassen and Land (2000) suggested is necessary for learners to take ownership of their knowledge and construct their own understanding of the cognitive puzzles they encounter.

Brown and Campione (1994) made an insightful distinction between “discovery learning” and “guided discovery” in curriculum design. On the one hand, discovery learning resonates with the idea of learners actively constructing their own knowledge through individually driven inquiry, experimentation, and testing of one’s own understandings. Guided discovery, on the other hand, also requires active learners, but the learning is co-constructed through learners’ engagement in carefully designed curriculum that involves a “community of discourse” through which the teacher must “model, foster, and guide the ‘discovery’ process into forms of disciplined inquiry” (Brown & Campione, p. 230). One important component of the community of discourse involves checking reading comprehension; in small groups, students engage in reciprocal teaching as they summarize, question, and clarify their understandings of a conceptually challenging reading, and then share their perspectives with other groups. As instructors, it may be necessary to diversify the ways in which students encounter and engage with the different claims in Mercer’s *Child Development* that go beyond reading refutational text and being presented with refutational lectures, in order for students to reject and/or revise their misunderstandings. One strategy would be to more frequently integrate some of the myths into class discussions and activities to provide students with opportunities to challenge and engage each other in refuting the myths, and using the textbook and/or research articles provided by the instructor, model—and then engage students in—evidence-based inquiry with each other. Furthermore, in order to enact the desired conceptual change, it may be prudent to have students respond to each claim in a weekly diary, which would provide them with more frequent practice in active engagement in their own problem solving process than the infrequent written assignments. That is, an instructor could have students read a claim each week, and after some class discussion of the reading, provide a brief diary-like response to the information, particularly as it relates to the content from the course, which could be framed as confirmatory or negatory with personal understanding thus far.

Limitations

The findings in this study should be interpreted in light of certain limitations. First, the sample size is relatively small to make broad generalizations. In addition, the majors of the participants may have influenced how cognizant they are of the issues included in the claims as written. That is, as mostly Liberal Studies and Psychology majors, they may be aware of developmental issues given their interest in their respective course of study. There may be more evidence of change in beliefs with a more heterogeneous sample from a General Education course, for example. Methodologically, as previously noted, responding to three of the claims may not be sufficient to overall beliefs as reflected in the measure. We have no evidence that students read all of the claims as assigned or in the pursuit of selecting a claim to which to respond (although students anecdotally said they did). In addition, Mercer’s narratives on the claims are not entirely definitive in their conclusion, which may not leave students with firm conclusions on the topics.

In response to the findings, curricular redesign will focus on integrating a set of the inaccurate claims into class discussions and activities. For instance, students could be divided into “pro” and “con” groups, one supporting the claim and the other arguing against it, providing the rationale and evidence from the textbook to support their arguments. The instructor could ask students to read a research study that provides evidence refuting the claim and explain to the class how the research addresses the inaccuracies of the claim. In addition, instructors could have

students reflect on the content of each textbook chapter and generate a list of content that uninformed people may have incorrect about child development. For example, students might point out the amount of embryonic development and the teratogenic effects of certain substances, such as alcohol. In this way, a class list of myths and misunderstanding may be created that could also be used in short answer and essay questions on tests to reinforce conceptual change. Also, students could develop multimedia public service announcements to correct or reframe the myths and misunderstandings they discover within the text.

In order for students to become active participants in their learning, we contend it is not enough to tell them that their ideas are wrong or inaccurate; rather, it is important to engage students in the process of exploring how and why our long-held beliefs may have led us to inaccurate understandings. Jonassen and Land (2000) suggested that “meaning making is a process of social negotiation among participants in any activity [and that] learning, from this perspective, is dialogue, a process of internal as well as social negotiation” (p. 4). Students should be provided with more frequent opportunities to engage in internal (through written assignments) and social (through class activities and discussions) dialogues that question their folk understandings of family science. As Keil (2008) suggested, these internal and social dialogues “help students appreciate the limits of their understanding, [and] to outsource understanding to other minds” (p. 196). Indeed, Keil argued that schools are the perfect setting to engage learners in social negotiations that outsource their understandings to others.

In schools, students engage in the “uniquely human social information processing required for learning about complex artifacts and other cultural creations, such as formal science, that go beyond folk belief systems” (Keil, 2008, p. 201). In concordance with Keil, Geary (2008) also sees formal school settings as the context in which learners are socially engaged and motivated to participate in “controlled problem solving,” which he believes is cognitively required to move beyond folk systems of knowledge and learn academic domains of knowledge. It is essential that pedagogical approaches challenge and engage students in the process of questioning, investigating the veracity of, and revising their long-held beliefs and assumptions in domains of knowledge such as human behavior and development with which they have had years of experience. Rather than being the voice of expertise and authority that simply refutes students’ misconceptions, our job as instructors is to engage students in problem-solving activities that not only challenge students’ thinking and create cognitive dissonance, but also provide students with the materials, tools, evidence, and information to rethink and revise their understandings with each other and on their own.

In the future, it may be worthwhile to collect data from those who teach human development and family science courses to determine if there are common misconceptions that may not have been addressed by Mercer and to perhaps determine if there is a superordinate set of misconceptions that instructors can deliberately address through instruction and assignments. Also, focusing on the myths and misunderstandings as a *core* text and using a typical Child Development textbook as a *supplemental* text may help provoke more conceptual change. For example, in order to address the conclusion of the claim, students would need to provide evidence from the child development textbook, thereby encouraging their use of an authoritative source to address a potential misconception.

Dr. Robert S. Weisskitch is a Professor of Human Development in the Liberal Arts Department at California State University, Monterey Bay, CA in Seaside, CA 93955.

Dr. Deanne R. Perez-Granados is as Associate Professor of Human Development in the Liberal Arts Department at California State University, Monterey Bay, CA in Seaside, CA 93955.

References

- Arntzen, E., Lokke, J., Lokke, G., & Eilertsen, D. (2010). On misconceptions about behavior analysis among university students and teachers. *The Psychological Record*, *60*(2), 325-336.
- Brown, A. L., & Campione, J. C. (1994). Guided discovery in a community of learners. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 229-270). Cambridge, MA: MIT Press.
- Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instruction. In A. Kozulin, B. Gindis, V. Ageyev, & S. Miller (Eds.), *Vygotsky's educational theory in cultural context* (pp. 39-63). New York: Cambridge University Press.
- Geary, D. C. (2008). An evolutionarily informed education science. *Educational Psychologist*, *43*(4), 179-195.
- Guzzetti, B. J. (2000). Learning counter-intuitive science concepts: What have we learned from over a decade of research? *Reading & Writing Quarterly: Overcoming Learning Difficulties*, *16*(2), 89-98. doi:10.1080/105735600277971
- Hynd, C., Alvermann, D., & Qian, G. (1997). Preservice elementary school teachers' conceptual change about projectile motion: Refutation text, demonstration, affective factors, and relevance. *Science Education*, *81*(1), 1-27. doi:10.1002/(SICI)1098-237X(199701)81:1
- Jonassen, D. H., & Land, S. M. (2000). Preface. In D. H. Jonassen & S. M. Land (Eds.), *Theoretical foundations of learning environments* (pp. iii-xiii). Mahwah, NJ: Lawrence Erlbaum Associates.
- Keil, F. C. (2008). Adapted minds and evolved schools. *Educational Psychologist*, *43*(4), 196-202. doi:10.1080/00461520802392232
- Kowalski, P., & Taylor, A. (2004). Ability and critical thinking as predictors of change in students' psychological misconceptions. *Journal of Instructional Psychology*, *31*(4), 297-303.
- Kowalski, P., & Taylor, A. (2009). The effect of refuting misconceptions in the introductory psychology class. *Teaching of Psychology*, *36*(3), 153-159. doi:10.1080/00986280902959986

- Kuhle, B. X., Barber, J. M., & Bristol, A. S. (2009). Predicting students' performance in introductory psychology from their psychology misconceptions. *Journal of Instructional Psychology, 36*(2), 119-124.
- Mercer, J. (2010). *Child development: Myths and misunderstandings*. Thousand Oaks, CA: Sage.
- Miller, P. H., & Aloise, P. A. (1989). Young children's understanding of the psychological causes of behavior: A review. *Child Development, 60*(2), 257-285.
- Miller, R. L., Wozniak, W. J., Rust, M. R., Miller, B. R., & Slezak, J. (2002). Counterattitudinal advocacy as a means of enhancing instructional effectiveness: How to teach students what they do not want to know. In R. A. Griggs (Ed.), *Handbook for teaching introductory psychology: Vol. 3: With an emphasis on assessment* (pp. 43-48). Mahwah, NJ: Lawrence Erlbaum Associates.
- Swami, V., Stieger, S., Pietschnig, J., Nader, I. W., & Voracek, M. (2012). Using more than 10% of our brains: Examining belief in science-related myths from an individual differences perspective. *Learning and Individual Differences, 22*(3), 404-408.
- Vaughan, E. D. (1977). Misconceptions about psychology among introductory college students. *Teaching of Psychology, 4*(3), 138-141.
- Wellman, H. M., & Gelman, S. A. (1992). Cognitive development: Foundational theories of core domains. *Annual Review of Psychology, 43*, 337-375.
doi:10.1146/annurev.ps.43.020192.002005

Table 1

Pre- and Post-Means for Each Claim by Group

	Experimental		Control		<i>F</i> (1, 67)
	Pre	Post	Pre	Post	
Claim 1	3.65 (1.08)	3.19 (1.22)	3.61 (1.26)	3.66 (1.30)	1.89
Claim 2	1.90 (1.04)	2.03 (1.05)	1.92 (1.02)	1.97 (1.39)	0.04
Claim 3	4.16 (1.90)	3.10 (1.70)	3.24 (1.97)	3.18 (1.83)	4.84*
Claim 4	4.32 (1.05)	3.94 (1.09)	3.84 (1.24)	3.76 (1.17)	1.55
Claim 5	4.84 (1.21)	3.74 (1.41)	4.82 (1.21)	4.39 (1.39)	4.28*
Claim 6	4.58 (1.15)	3.35 (1.52)	4.53 (1.29)	4.45 (1.18)	10.15**
Claim 7	3.97 (1.66)	3.48 (1.48)	3.66 (1.78)	3.58 (1.65)	1.01
Claim 8	4.23 (1.23)	3.81 (1.25)	3.92 (1.24)	3.76 (1.08)	0.61
Claim 9	3.52 (1.63)	2.00 (1.34)	3.68 (1.66)	2.97 (1.48)	3.51
Claim 10	3.16 (1.16)	2.84 (1.44)	2.97 (1.55)	2.92 (1.19)	0.81
Claim 11	1.52 (0.85)	1.71 (1.07)	1.45 (0.80)	1.63 (0.63)	0.00
Claim 12	4.48 (1.15)	4.42 (1.21)	4.79 (0.99)	4.53 (1.13)	0.39
Claim 13	2.29 (1.32)	2.58 (1.43)	2.03 (1.13)	1.47 (1.06)	12.36***
Claim 14	2.35 (1.40)	2.29 (1.13)	2.11 (0.98)	1.97 (1.05)	0.05
Claim 15	2.13 (1.46)	2.06 (1.18)	2.08 (1.26)	2.47 (1.52)	2.44
Claim 16	4.35 (1.25)	4.32 (1.28)	4.76 (0.97)	4.79 (1.09)	0.03
Claim 17	3.03 (1.30)	2.97 (1.25)	3.05 (1.36)	3.08 (1.28)	0.07
Claim 18	2.00 (1.03)	2.16 (1.24)	1.74 (0.89)	1.71 (0.93)	0.46
Claim 19	3.65 (1.33)	3.39 (1.33)	2.87 (1.49)	2.42 (1.39)	0.37
Claim 20	5.13 (1.09)	5.03 (1.28)	5.05 (1.14)	4.92 (1.12)	0.03
Claim 21	4.45 (1.29)	3.97 (1.20)	4.24 (1.32)	4.11 (1.22)	1.69
Claim 22	5.32 (0.65)	4.94 (1.06)	5.16 (0.92)	5.05 (0.87)	1.40
Claim 23	4.45 (1.09)	3.97 (1.35)	4.37 (1.42)	4.16 (1.39)	1.29
Claim 24	4.77 (0.72)	4.68 (0.65)	4.03 (0.92)	4.18 (0.80)	1.97
Claim 25	3.74 (1.55)	3.03 (1.40)	3.21 (1.30)	3.53 (1.59)	11.72***

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Appendix

Summary Titles of the Claims Used in the Pretest and Posttest Measure

- Genetic factors play such a strong role in human development that genes alone can determine certain human behavioral characteristics.
- Unborn babies are not influenced much by the environment outside the mother's body.
- As a mother-to-be gets closer to the date when her baby will be born, she needs to be more careful about alcohol and drugs because the risk of birth defects increases throughout pregnancy.
- Mothers care for their babies well because they have a maternal instinct.
- Parents need to have contact with babies right after birth, so they can bond with them.
- Babies are born with emotional attachment to their mothers and can recognize their mothers at once.
- Babies cannot see when they are first born.
- Development of the brain is caused by experience, so it's possible to cause quick cognitive or emotional changes by stimulating a child's brain the right way.
- Parents should not talk baby talk to their children because this slows their language development.
- Breast-feeding makes babies more intelligent.
- Toddlers drop food on the floor because they want to make their parents mad.
- The time between birth and age 3 is the most important period of development and learning in a person's life.
- Vaccines are a cause of autism.
- Preschoolers who try to bargain with their parents really want to manipulate and control adults, and they should not be allowed to negotiate.
- Children who play with matches will grow up to be seriously disturbed and violent and will probably be serial killers, especially if they are also cruel to animals and wet their beds.
- Children have different learning styles, depending on whether they are left-brained or right-brained.
- Birth order is an important factor that determines children's intelligence and personality.
- Bullying is a natural behavior for children, and there's nothing you can do to stop it.
- Sugar is a major cause of hyperactive behavior.
- It is important for parents to be fair and treat all their children in the same way.
- Violent television programs and video games cause increased aggressive behavior.
- High self-esteem makes children perform better in school.
- The D.A.R.E. program is an effective way to prevent children and adolescents from dealing or using drugs.
- Children and adolescents learn bad behavior from their peers.
- Young teenagers should be tried and sentenced as adults if they commit serious crimes.