# TRAINING IN TBRI: CASE-BASED LEARNING AND THE TESTING EFFECT

by

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## ABSTRACT

Trust-Based Relational Intervention (TBRI®) is a holistic approach to parenting intended for parents and professionals working with children from "hard places," like foster children or adopted children. TCU's Institute of Child Development frequently holds week-long TBRI® training sessions for hundreds of adults in a variety of settings, including children's camps, family camps, home programs, and residential treatment facilities. The primary inspiration for this study was the question, "How can we best educate individuals on the TBRI® parenting model?" One reliable finding in the literature on learning and memory is the testing effect. In this experiment, three groups of college students learned the same basic outline of TBRI® in the first phase. In the second phase, each group is exposed to a different form of learning. The first group reads an expanded academic article of the initial TBRI® outline. The second group reads scenarios of parents and professionals using TBRI® and reads questions about the scenarios with the answer clearly marked. The third group – the testing effect groups – reads the same scenarios and questions as the second, but they also attempt to answer the questions and receive feedback about their answers. In the final test phase, all groups watch four videos of professionals using TBRI® with children and answer questions about the videos. Results suggest a difference between the third group and the other two groups. Additional subjective measures, such as enjoyment and confidence paint a richer picture of each group's experience. The implications of these results will be discussed.

TABLE OF CONTENTS

## INTRODUCTION

In many competencies, professionals must be able to utilize a complex body of knowledge in a systematic, organized way to solve problems. Studies have shown that expertise in professions like firefighting, nursing, and psychotherapy is context dependent; problem solving processes are highly specific to a given situation (Thomas, O'Connor, Albert, Boutain and Brandt,2001). One way to enhance the generalizability of problem solving to novel situations is to recognize underlying patterns present in situations. The primary method of developing rapid pattern recognition, the capacity to swiftly perceive patterns that indicate how best to approach a given scenario, or intuitive expertise is experience (Kahneman & Klein, 2009). However, new practitioners have not had the years of experience in the field needed to develop this expertise. Consequently, educators have looked for training procedures for enhancing pattern recognition in the absence of years of experience. One such procedure, case-based learning, has gained prominence in the education of young professionals. Case-based learning allows students to work through and analyze realistic examples of problem-solving scenarios (e.g., with hypothetical patients and clients). Case-based learning also allows for the development of highly specified knowledge derived from experiences that cannot be taught in a textbook or classroom setting.

In one study on the effectiveness of case-based learning, young psychiatric nursing students had to treat standardized persons (SP's), who are lay persons trained to act out specific patient scenarios with particular symptoms and conditions (Thomas et al., 2001). These simulated patient cases allowed the nursing faculty to control emphasis and complexity of the content and provide a common learning experience across the class. In one example scenario, a 30 year-old woman exhibited symptoms indicative of

depression, gastrointestinal disorder, and unhealthy alcohol consumption. The faculty could present alternate versions of the same case to best fit the group of students being tested. Hypothetically, younger students could see a less complex combination of symptoms; students in a gastroenterology course could see a heavier emphasis on woman's intestinal disorder. Prior to the use of case-based learning in fields like psychiatric nursing, professional educators aimed to teach general solving ability to be applied across all scenarios. Research has since shown that expert reasoning is specific and highly contingent on factors unique to each situation (Mandin, Jones,Woloschuk, & Harasym, 1997). Thomas et al. (2001) found that use of standardized-persons cases, written cases, and web module cases provided opportunities for students to generate experiences, boosted their confidence, and made their clinical reasoning skills more accessible for educators to guide and critique.

The use of case-based learning may be combined with other techniques to improve learning. One such technique is the retrieval practice effect. The act of retrieving information, i.e. intentionally pulling a piece of information from memory regarding an event or knowledge recently gained, enhances subsequent recall of that information. For example, when a mother asks her son what he learned at school that day, the act of verbalizing what he learned will increase the speed with which he can recall that information at a later date. In one instance of the retrieval effect, repeated retrieval (i.e., testing) of new information learned at the beginning of the experiment (without the opportunity to restudy the material) improved future recall more than restudying the material without being tested (Karpicke & Roediger, 2008). Karpicke & Roediger, (2008) trained students with foreign vocabulary words to examine the retrieval

effect, but a more recent study used chapter material from an ongoing course. Roediger, McDaniel, Agarwal, Huelser and McDermott (2011) performed a study in which 139 eighth grade students were quizzed by clicker response three times prior to an examination: once after reading the chapter but before lecture on the chapter material, immediately after lecture, and one day before the unit exams. Specific topics within each field were intentionally left out of the quizzes. Participants were placed in 6 different groups, each group being quizzed on different fields within science (e.g., anatomy, genetics). On the examination, students in each group performed significantly better on questions covering topics from previous quizzes than questions on the topics that were intentionally left out – the testing effect. Interestingly, the testing effect persisted on their final exam 9 months later. These findings are part of a growing body of evidence that retrieval practice in the classroom boosts academic performance (McDaniel et al., 2007; Wheeler & Roediger, 1992).

This current study aimed to evaluate if the testing effect, a finding previously studied almost exclusively within the context of memorization of rote academic knowledge, would emerge when participants apply learned material to unique scenarios, further strengthening the argument for case-based learning. Furthermore, this study evaluates whether techniques that improve learning can be extended to other areas where experience leads to better decisions, including parenting. We hypothesized that participants engaging in questions that address parenting scenarios and receiving feedback on their answers would most effectively learn the methods of TBRI® (TBRI® parenting model). TBRI® is a holistic approach to parenting intended for parents and professionals working with children from “hard places,” like foster children or adopted

children. Its structure focuses on three overarching principles: empowering, connecting, and correcting. That order is essential. Children must feel safe and provided for, and then connected to and truly loved by caregivers before any real growth or correction can take place. The Institute of Child Development (ICD) trains Trust-Based Relational Intervention to parents and professionals in a variety of settings including children's camps, family camps, home programs, and residential treatment facilities.

This study taught college students a basic outline of TBRI® principles and strategies. The students then relearned and supplemented the information from the outline by one of three methods: reading a more in-depth article on TBRI®; reading scenarios of working with children and reading pre-answered questions on these scenarios; and reading the same scenarios and questions, then actually answering said questions and receiving feedback on correct or incorrect answers. All groups then answered questions addressing four videos depicting professionals utilizing TBRI®. Because these students had to retrieve the newly learned information, the group that answered questions, entitled the case-based test (CB test) group, was predicted to perform the best on the final test. The case-based study (CB study) group, which read the answered questions, was expected to follow, and the principle-based study (PB study) group which simply read more on the subject was expected to perform the poorest. Primarily, the concluding qualitative measures of the study reported how confident participants felt about their performance and how much they enjoyed the experience. We predicted that the CB study and PB group would feel the most confident for the video test. This difference was anticipated because they received no tests of their memory to cause them to evaluate critically what they have learned. We expected the CB test group to feel the most

prepared and report a higher value for the technique, due to a better understanding of how TBRI can be used. One of the goals of the study was to determine whether future trainees of TBRI would enjoy case-based learning. However, we had no predictions regarding whether or not participants would rate higher enjoyment for one treatment over another, or be more likely to recommend TRBI® to a friend as a function of treatment condition.

## METHOD

**Participants.** A total of 93 undergraduate students, (21 male and 72 female, aged 18-24) at Texas Christian University (TCU) participated as a partial fulfillment of course requirements. None of the students had any previous experience with TBRI®, and were all informed as to the general purpose of the experiment: to investigate improvements for TBRI® training. Participants went through the survey and videos in groups of 23-25. Four groups of participants completed the task on separate days. The duration of the experiment was 50 min. All research was conducted with an approved Internal Review Board IRB protocol.

**Materials.** The experiment took place in a computer lab holding twenty-six computers. Participants used computers to read content and answer questions in a Qualtrics survey. All written scenarios came from anonymous written questionnaires collected from parents and professionals by the Institute of Child Development (ICD). The questions were either directly taken from the ICD website or written to model the structure and approach of the questions from the website. The participants also watched four videos provided by the ICD through a private YouTube account. Participants listened to the audio from these videos through their own ear buds that they were instructed to bring.

**Design and Procedures.** Participants were assigned to one of three groups and then read materials, watched short videos, and answered questions on a computer. Each group experienced two phases of training and one testing phase. In Phase 1 of the experiment, all three groups read the same brief, two-page article that outlines the three sets of principles of TBRI® and some basic strategies that come from each set (see Appendix A). Participants were given a minimum of five minutes and a maximum of ten minutes to complete Phase 1. The computer signaled the time to move onto Phase 2.

In the Phase 2 of the experiment, the principle-based (PB) study control group read a much more detailed article describing the tenets, purpose, and reasoning behind TBRI®. This article largely describes TBRI® without examples of "real life," day-to-day scenarios with children. Consistent with procedures investigating the testing effect, for the PB study group this represented an additional opportunity to study the principles of TBRI®. The case-based (CB) test group read seven examples of scenarios with children. Each scenario was accompanied by questions on the principles of TBRI (seven multiple choice questions with 4 or 5 answer options, and two true or false questions; see Appendix B for examples), Participants were required to answer the question before receiving feedback. Following the participants choice, a text box was shown with an explanation of the correct answer and why the other options were false. The PB study and CB test groups differed not only in the content they were exposed to, but also the format of the material. The former group read about TBRI® from an article previously published to an academic journal while the latter group learned about TBRI® through feedback received after answering scenario questions. A second control group was included to rule out some of these confounds, which may explain differences between the

PB study and CB test groups. The CB study group read the same scenarios and questions as the CB test group but the correct answer was underlined in each question to discourage participants from attempting to answer the question. The same information regarding the correct and incorrect answer choices was provided. This phase took 15-20 minutes, after which participants were instructed by the computer to move on to Phase 3.

In Phase 3, every participant viewed four, 2 to 3 minute video scenarios of professionals and volunteers from the TCU Institute of Child Development working with children. Each video was accompanied by five multiple- choice questions with four or five options each (see Appendix B) that assessed how well they understood TBRI®, its principles, and its strategies for handling scenarios with children. Participants had approximately 30mins to complete this test. After watching each video and answering accompanying questions, participants were prompted to answer five questions describing their attitudes about the study. On a five-point Likert scale, participants stated their likelihood of recommending the educational tool to a friend and their likelihood of recommending TBRI® to a friend. The students then rated on a scale of zero to one hundred how much they enjoyed the study, how prepared they felt for the final test, and how confident they felt about their answers on the final test.

**Data Analysis.** The mean percent correct (correctly answered divided by total questions) was calculated per participant and analyzed via parametric tests. The qualitative measures of likelihood of recommending the study tool, likelihood of recommending TBRI®, and level of enjoyment, feelings of preparedness, and feelings of confidence were all reported as mean response per group.

**RESULTS**

A standard outlier analysis (mean ± 2 x standard deviation) was conducted on the percent correct scores and resulted in the removal of 1 subject from Groups 1 (n = 31) and 3 (n = 31). Figure 1 displays the mean percent correct of participants in the PB study, CB study, and CB test groups. Figure 1 indicates very similar performance by the PB study and CB study groups. An independent *t*-test conducted on mean percent correct revealed the difference between the mean scores of the PB study group and the CB study group was minimal, $t(30)=0.01$, $p=0.99$. Figure 1 also indicates that the PB study group scored lower on average than the CB test group. A similar *t*-test revealed the difference between the mean scores of the PB study group and the CB test group was marginally non significant, $t(30)=1.82$ and $p=0.07$, $d=0.48$. Lastly, a similar difference between the mean scores of the PB study group and the CB test group can also be observed in Figure 1, $t(30)=1.69$, $p=0.1$, $d=0.44$.

Figure 2 includes a table of the self-reported qualitative data that was collected after participants completed the Test Phase. A brief post-test survey asked participants to rate their likelihood of recommending TBRI® to a friend and their likelihood of recommending the educational tool within the experiment on a five point Likert scale. They also rated their enjoyment, confidence in their answers, and confidence in their preparation on a scale of one to one hundred. The qualitative data and the differences between groups' means scores are depicted in the figures below. Many of the measures indicated equal to or higher ratings for the CB test group over the PB study group. A repeated measures analysis of variance (ANOVA) was conducted on the measures that were recorded using a Likert scale with Group (identify groups) and Rating (identify

scale) as the repeated measures. This test revealed no significant main effects *f*s (2, 56) < 1.92, *p*s > .15 or the interaction, *f*s (4, 112) = .93, *p*s = .45.Though many of the measure indicated equal to or higher ratings for the CB test group over the PB study group, none of these differences was significant, ts<0.09, ps>0.90. The CB test group enjoyed the experiment more than the other two groups, the strongest difference between groups. The CB study and CB test groups had more similar confidence in their final answers. The CB study and the CB test group had more similar confidence in their preparation for Phase 3. The likelihood of recommending the tool was somewhat similar between the PB study and CB test group. The likelihood of recommending TBRI® to a friend was more similar between the CB study group and the CB test group.

**DISCUSSION**

Because of their opportunity to receive the benefits of memory retrieval, the CB test group was expected to perform better than both of the study groups. The study groups were expected to perform fairly similarly; the CB study group was expect to score slightly higher because of exposure to authentic scenarios of TBRI® application. The CB test group performed better than both the PB study group and CB study group. Though the parametric tests revealed marginal non-significance, Cohen's d, a measure of effect size, revealed moderate effect sizes. Consistent with our predictions, the difference between the PB study group and the CB study group not only failed to be significant, but produced nearly equal mean scores. The differences in between groups across the qualitative measure were insignificant. The CB test group enjoyed the experiment more than the PB and CB study groups, and the CB study and CB test groups had more confidence in their preparation and in their answers. One could attribute the CB test

group's confidence to their exposure to testing as opposed to legitimate feelings of preparation. However, the feedback that they received in Phase 2 which often informed them of answering incorrectly theoretically counteracted any confidence boost derived from the mere process of testing.

Though the Cohen's d significance and the marginal non-significance of the t test are not strong indicators on their own, the combined consideration of both presents a stronger statistical case for support of the original hypothesis. The comparative success of the CB test group may be attributed to the testing effect as a result of retrieval practice. Neither the PB study group nor the CB study group practiced recalling the information that they learned in Phase 1, while the CB test group retrieved that information from memory to answer 49 questions. Supporting the learning process of the CB test group, McDaniel et al. (2011) found evidence suggesting that the testing effect transfers to test questions that require more application of the previously learned material and are presented in different testing formats (e.g., short answer) than rudimentary recognition-based multiple choice questions. Though all participants answered multiple choice questions in Phase 3, the questions required participants to process the content of the videos and apply their knowledge, going beyond the base recognition of the correct answer among incorrect answers in standard multiple choice questions. Both written cases and video cases have been utilized effectively in case-based learning. Thomas et al (2001) saw their nursing students' context specific knowledge and overall confidence improve after they worked through written cases of patient scenarios. Balslev, de Grave, Muijtjens, & Scherpbier (2005) showed that groups of pediatric students who watched a case vignette video as opposed to reading about it had much more "clause categories and

clause frequency" in their group discussion. Clause categories included process level, theory building, theory evaluation and metareasoning. Essentially, more overall clauses indicate more discussion and greater diversity of clauses suggests greater understanding and deeper conceptualizing.

Despite this support for the effectiveness of the methods of this study and the testing effect within the CB test group, because students typically attempt to answer questions correctly, participants in the CB test group may have simply spent more time on the question pages and absorbed the information more because of exposure. The PB study group and CB study group participants usually completed the experiment before the CB test group participants. Those who finished especially early very well may have skimmed through their article or questions, simply trying to be done with the experiment. Students receive credit for their classes by participating in experiments; their motivations to perform well do not exceed simple good will, integrity, and desire to further science.

The near significance of the difference between the PB study group and the CB test suggests that the question format acts as a more effective tool for learning than reading dense academic articles. The strong similarity of the mean scores of the PB study group and the CB study group further suggests that answering questions and receiving subsequent feedback improves upon reading over correctly answered questions. The current data, however, does not allow these concepts to fall into the category of evidence-based theory. Various confounds may account for the weakness of the data. Experiments either occurred at 9:00am or 4:00pm, when college students have just woken up or prepared to finish an arduous day of classes. The mixture of written scenarios and video scenarios may have also detracted from performance. Though participants' practiced with

scenarios taken from real stories reported by parents and professionals, the transition from processing written scenarios to analyzing video footage may have been mentally taxing at the conclusion of the experiment. Future research would ideally take place during a time of day associated with high mental performance for the population undergoing the experiment, e.g. mid-morning for college students. Moreover, a follow up study could separate the current project into two experiments, one with only video scenarios and one with only written scenarios. This approach could eliminate the potential confound of information medium transition as well as assess the comparative effectiveness of written case-based learning and video case-based learning.

This study sought to contribute to effective training of the parenting model, TBRI®. Though the data did not conclusively reveal the testing effect to be present within TBRI® training, it did indicate the superiority of recall practice over study in both performance and enjoyment. Quizzing and testing throughout the education of TBRI® could improve parents' and professionals' learning experience.

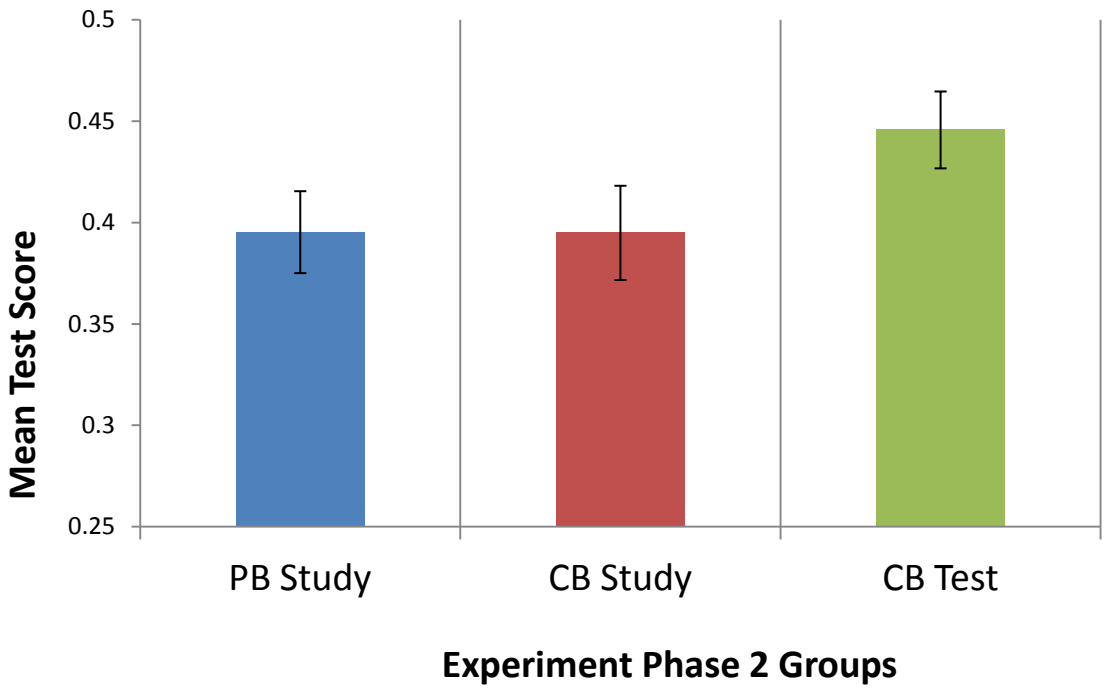


Figure 1. Mean scores of each Phase 2 group on Phase 3 test (PB study, CB study, and CB test).

| | Average of Tool | Average of Friend | Average of Enjoyment | Average of Confidence | Average of Prepared |
|---|---|---|---|---|---|
| PB Study | 3.60 | 3.33 | 55.60 | 49.67 | 53.97 |
| CB Study | 3.60 | 3.47 | 53.37 | 54.07 | 59.10 |
| CB Test | 3.80 | 3.43 | 61.10 | 53.17 | 59.17 |

Figure 2. Mean scores on qualitative measures for each Phase 2 group.

Appendix A

Trust-Based Relational Intervention®

A Descriptive Outline for "Training in TBRI: A Comparison of Principle-Based and Case-Based Learning" research study

Trust-Based Relational Intervention® (TBRI®) is a trauma-informed, evidence-based program for caregivers and professionals who work with children who "come from hard places." By this we mean children who have experienced relationship-based traumas such as maltreatment, neglect, domestic violence, and/or multiple home placements. TBRI® works because it is designed to meet the basic relationship and developmental needs of these children, as well as the needs of the adults who seek to help them heal, learn and grow. TBRI® consists of three sets of principles, that are synergistic in their effects: Empowering Principles, Connecting Principles, and Correcting Principles. In this short document we briefly describe some of the principles, practices, and strategies that make up TBRI®.

Empowering Change

The Empowering Principles are designed to facilitate self-regulation and learning through two sets of strategies: Ecological and Physiological.

Ecological Strategies focus on the caregiving or learning environment external to the child or adolescent; Ecological Strategies include the following:

• Daily Transitions: By managing daily transitions (e.g., changing classes or subjects) we can teach self-regulation and reduce misbehavior.

• Scaffolding: By supporting emerging skills (e.g., emotional self-regulation) in a sensitive yet instructive manner, we can build social competence.

• Daily Rituals: By incorporating rituals into our daily routine (e.g., morning meetings), we provide the foundations for trusting relationships and academic success.

Physiological Strategies focus on the environment internal to the child's body and brain; Physiological Strategies include the following:

• Hydration: By ensuring adequate hydration, and avoiding dehydration, we can help optimize children's capacities for attention, learning, and memory.

• Glucose: By ensuring that blood sugar levels are appropriately stable, we can help optimize children's capacities for executive function, learning, and memory.

• Sensory Experiences: By attending to children's sensory needs we can also help optimize children's capacities for executive function, attention, and learning.

Creating Connections

The Connecting Principles are designed to facilitate felt safety and the growth of in class relationships through two sets of strategies: Engagement and Mindfulness.

Engagement Strategies focus on the nonverbal aspects of adult-child interactions that are actually most salient to children and adolescents; these include the following:

• Authoritative Voice Quality: The emotional tone of our voice easily trumps the semantic content of our words, and traumatized children are especially sensitive.

• Behavior Matching: By matching behavior, body position, or body posture, we subconsciously create a connection with the children we are trying to reach.

• Valuing Eye Contact: By requesting (but not forcing) eye contact, we enhance connection and attention to the content of our communication.

Mindfulness Strategies reflect a calm, attentive presence in the classroom; Mindfulness Strategies include the following:

• Calm Presence: Remaining calm is the key to working effectively with traumatized children and youth; lose your cool and you lose the game.

• Companionship: Effective teachers and caregivers are constantly creating connections with the youth they serve, in short, they are good companions.

• Situation Awareness: Expertise in the classroom is largely a matter of situation awareness: awareness of self, youth, and the overall situation.

Shaping Behavior

The Correcting Principles build on Empowering and Connecting, and are designed to build social competence through two sets of strategies: Proactive and Responsive. Proactive Strategies are designed to teach positive social skills and overall social competence; proactive strategies include the following:

• Choices: Giving children and adolescents choices (that you can live with!) is an extraordinarily powerful way to teach and structure challenging situations.

• Compromises: Like Choices, Compromises is a powerful script for teaching negotiation and structuring challenging situations.

• Life Value Terms: TBRI® is a culture of structure and nurture, and Life Value Terms are its language (e.g., “Can you say that again with respect?”).

Responsive Strategies include two powerful scripts for responding when challenged:

• IDEAL Response: According to this script, responses are Immediate, Direct (per the Engagement Strategies, above), Efficient (per Levels of Response, below), Action-Based (“I hear and forget, I see and I remember, I do and I understand”), and Leveled

at the behavior, and not the child.

• Levels of Response: According to this meta-script, the level or response matches the level of challenge: Playful Engagement (where we want to be most of the time), Structured Engagement (use of Choices, etc.), Calming Engagement (use of Time In, etc.), Protective Engagement (use of CPI or Satori methods).

Appendix B:

Mom: We had planned a trip to a mall (40 minute drive each way), where our 8 year old son would go with his twenty-one year old sister to a candy store while I did something else. It was getting too late and he was unraveling so I told him we couldn't go to the mall. He became furious, left the room, returned, and started arguing with me about why we weren't going, his voice pitch getting high. He was making fists and trying to look mean. I kept cool. He started relaxing and then crying at which time he was able to communicate that all he cared about was the candy. I grinned at him and asked him what his favorite kind was. He smiled slightly, then mumbled, "Twizzlers. Oh, and maybe Gobstoppers too Seeing that he was calmer, I suggested that he ask me for a compromise. He asked if we could take him into a convenience store very close to our house just to get some candy. I readily agreed, told him he did a good job asking, and apologized for not recognizing how important the trip to the candy store was for him.

Questions:

1. Which connecting strategy is NOT referred to/used in this scenario description?
    a. Calm Presence
    b. Daily Ritual
    c. <u>Valuing Eye Contact</u>
    d. Compromise

    Valuing Eye Contact. The mother keeps calm throughout the situation. She displays companionship by showing concern for his desire for candy and by holding him during his crying. She

instigated a fair and reasonable compromise, though it would have been more skillfully implemented before the child had a meltdown. Never does the description explicitly state making eye contact. Recall that eye contact should be a regular part of child interaction.

2. Children from hard places have difficulty transitioning. If a plan or daily ritual is abruptly diverted from, they struggle to self-regulate. What empowering strategy did the mom seem to use to help her son deal with his reactions to events like the one described here?
    a. Sensory Experiences
    b. <u>Scaffolding</u>
    c. Hydration
    d. Maintaining blood sugar

    Scaffolding. The mother utilized scaffolding, or supporting emerging skills, in this situation by supporting her son's emotional regulation by helping him cry. There were no sensory issues in this scenario. Water was not given. Candy could be interpreted as glucose, but it was a desired treat in this scenario, not a necessary provision.

3. What Correcting strategy was most effective in diffusing this situation?
    a. Life value terms
    b. Choices

c. Compromise

d. None of the above

Compromise. Choices and Life value terms were not used. The IDEAL response was present, with the mom arguably using engagement strategies like behavior matching and Levels of response with structured engagement strategies like Compromise. However, Compromise for candy at the convenience store was the focal point of the resolution.

4. True or False: The mother failed to playfully engage in this scenario.

False. By asking him about what candy he liked, the mother brought a playful tone and topic into the scenario.

References

Balslev, T., de Grave, W., Muijtjens, A., & Scherpbier, A. (2005). Comparison of text and video cases in postgraduate problem-based learning format. *Medical Education, Vol 39(11).* Doi: 10.1111/j.1365-2929.2005.02314.x

Kahneman, D. & Klein, G. (2009). Conditions for Intuitive Expertise: A failure to disagree. *American Psychologist, 64*(6), 515-526.

Karpicke, J. & Roediger, H. (2008). The Critical Importance of Retrieval for Learning. *Science, Vol 319 (5865).* Doi: 10.1126/science.1152408

Mandin, H., Jones, A., Woloschuk,W., & Harasym, P. (1997). Helping students learn to think like experts when solving clinical problems. *Academic Medicine, 72*, 173–179.

McDaniel, M. A., Anderson, J. L., Derbish, M. H., & Morrisette, N. (2007). Testing the testing effect in the classroom. *European Journal of Cognitive Psychology, 19*, 494 –513.

Roediger, H., McDaniel, M., Agarwal, P., Huelser, B., McDermott, K. (2011). Test-enhanced learning in a middle school science classroom: effects of quiz frequency and placement. *Journal of Educational Psychology, 103(2),* 399-414.

Thomas, M., O'Connor, F., Albert, M., Boutain, D., Brandt, P. (2001). Case-Based Teaching and Learning Experiences. *Issues in Mental Health Nursing, 22,* 517-531.

Wheeler, M. A., & Roediger, H. L. (1992). Disparate effects of repeated testing: Reconciling Ballard's (1913) and Bartlett's (1932) results. *Psychological Science, 3,* 240 –245.