

Critical Thinking in a Montessori Setting

An Action Research Report by

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Submitted on May 10, 2010

In fulfillment of final requirements for the MAED degree

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Advisor: _____ Date: _____

Abstract

The intent of this research was to find out if adopting a nine week intervention plan to integrate all aspects of critical thinking into a Montessori school would positively impact the students' abilities to process and synthesize knowledge using higher level thinking skills. The research study occurred in one, private, suburban Montessori school involving 135 students. The learners involved ranged in ages from three to fourteen. The data collection process included: (1) observational records, (2) student work samples, (3) interviews with teaching staff and (4) surveys. As a result of the implementation, the students' intellectual abilities to process using higher level thinking skills were positively affected. The results of this research indicate that placing emphasis on critical thinking, incorporating it into the curriculum across all subject areas and increasing teacher expectations positively affects the learners' outcomes in these areas.

Historically, our school community has expressed continued concern about our students, of varying ages and abilities, and their inability to engage in critical thinking activities beyond the full complement of Montessori materials. Although our classrooms are rich with concrete materials and offer a great deal of exploration through hands-on manipulative materials, the students overall seemed to lack the ability to make more complex application of their knowledge through critical thinking exercises. “Critical thinking involves higher level thinking skills, the process of thinking abstractly, the application of knowledge and a gradual progression from the superficial to the increasingly complex” (Mendelman, 2007, pg. 300). As noted, the students were primarily tied to the manipulation of the materials and experienced challenges when asked to think beyond their routine, classroom work and appeared to struggle with complex application of knowledge outside the materials. Over the past five years, the staff had attempted to increase the students’ abilities in this area by committing to add five new critical thinking works to their prepared environment each year, for five years. At the completion of this five year plan, there was not an overall improvement in this area and so the administration wanted to address this important issue as part of an action research project in an effort to seek more improvement and attain measured success in this area. As a traditional Montessori school, it was vital to facilitate learning to each child’s potential and make improvements, while also maintaining the same mission and teaching strategies adopted by the school and not compromising on the Montessori Method. The staff also wanted to make sure to foster the importance of developing higher level thinking throughout the school as an addition to the Montessori curriculum.

To begin to examine the strategies that could promote measured progress in the development of higher level thinking with the students, preliminary research was examined on current strategies for improvement in critical thinking. This research pointed to the fact that the potential cause of the problem could stem from a lack of professional development opportunities for the staff in the integration and assessments of critical thinking opportunities in the Montessori setting, the perceived lack of time during the school day to integrate higher level thinking into the curriculum and the general lack of focus on this issue, and its implementation, in regard to the school community. Interestingly, background research for the project also indicated that although there is a deficiency in higher level thinking for our nation, that critical thinking can be improved through the actual instruction of critical thinking across the curriculum. The same research noted that this is best accomplished in the offering of professional development for the staff on how to integrate this, in modeling critical thinking to the students by the staff and in the utilization of cooperative learning to promote better strategies for critical thinking in the classroom. Also, relevant information noted that age does not have to be a barrier for a student to acquire higher level thinking and so the inclusion of the preschool aged child in this study was of value. Because of this, it was decided to integrate critical thinking for all ages in the school, with the exception of toddlers.

Preliminary research also suggested that “students frequently perform at the level of teacher and administration expectation” (Law & Kaufold, 2009, pg. 29) and so it became obvious that if teacher’s focus and expectations rose, that perhaps student performance would as well. General and immersion strategies for critical thinking produced positive results in various studies that were evaluated and as a result, the staff

targeted the need to integrate critical thinking as much as possible, through various subject matters and throughout the school day. After examining the preliminary research, it made sense as to why simply the addition of critical thinking work into a classroom would not lead to improvement; it was going to be vital to offer professional development and focus in this area for the staff, initiate the modeling of critical thinking to the students, fostering creativity and cooperative learning opportunities throughout all subject matters, and actually “teach” the methods and steps involved in the utilization of higher level thinking to make improvements and spur student interest. As noted in current research, “to promote critical thinking skills in children, teachers must be interventional in their practices and diligent about evaluating their effectiveness” (Espstein, 2008, pg. 38). With focus on this method for a nine week implementation period, it was also anticipated that the students would gain in their confidence, encouraging an atmosphere within the school that facilitated a more open exchange of higher level problem solving and intellectual stimulation.

As the preliminary research was analyzed and developed and the staff discussed the need to improve the situation they posed the question: “What effect will an action plan that targets critical thinking in a Montessori setting for preschool through middle school students for a nine week period have on the student’s ability to think constructively and utilize higher level thinking skills?” The research study occurred in one private, Montessori school in Birmingham, Alabama, involving classrooms from preschool through middle school, which included 135 students. Specifically, the action research project involved three preschool classrooms, two lower elementary classes, one upper elementary and one middle school class. For the purposes of the study, data was

collected from all classrooms but the reporting of data from one lower elementary (six to nine year old) group was examined more closely for the purposes of analyzing the data in more detail and determining the effect of the intervention. The teachers that implemented the plan were nine in total, ranging in experience between 5 and 25 years and all were certified in Montessori education, with undergraduate or graduate degrees.

Description of Research Process

The nearly school wide implementation of the action research began on January 25, 2010 and ended on March 26, 2010. For the purposes of the study, the Montessori certified lead teachers of classrooms ranging from preschool through middle school age children utilized a nine week period to purposefully integrate critical thinking lessons and opportunities throughout the school day, while also simultaneously collecting data on student performance and confidence in this area. Previous research indicated that targeting an expected increase in critical thinking in a school environment should include an “infusion approach” (Angell & Valanides, 2008, pg. 322). Therefore, the goal for the plan was to not compromise or alter the already existing Montessori curriculum in place, but to enhance instruction by offering critical thinking opportunities and extensions as much as possible and throughout each learner’s lessons in an effort to determine if improvements could be made in the student’s ability to apply knowledge, think abstractly and even respond more frequently when questioned on making intellectual connections beyond the hands-on materials, programming and three period lessons already in place. As mentioned, the concern over critical thinking was expressed across the school, with

nine out of the nine certified, lead Montessori instructors noting that there was an issue in this area prior to the implementation. In particular, it seemed to be a concern for teachers of children between the ages of six and nine, the developmental level where children are typically transitioning from more concrete to more abstract thinking. The deficiency in this area for the younger elementary students was noted after analyzing the student's performance in the examination of the last two year's annual standardized test, the SAT-10. Also, the preschool teachers, working with children from the ages of three to six, wanted to begin to assist the children in making inferences and encourage more of an atmosphere where intellectual boundaries were broadened beyond the already comprehensive curriculum in place to assist the children during their elementary years. As one might imagine, the upper elementary and middle school aged children were already offered higher level challenges daily and were assessed as part of their normal reporting process but the teachers of this academic level also wanted to work to attain measured progress and an increased focus in this area.

The nine week intervention period began with professional development on critical thinking and group, as well as individual surveys, of the staff and their desire to make improvements in this area. Data indicated that at all levels, particularly for the students between the ages of three and nine, that the students were having challenges when asked to think and analyze beyond the initial offerings of lessons and activities in the classroom. Although initially, the task of offering at least one new critical thinking opportunity for each child seemed daunting, the staff involved committed to insert critical thinking through lectures, science/lab experiments, homework, quantitative exercises, writing activities and group discussions each day, for the period of the nine week

implementation. Fortunately, once the nine week period began, the staff found this was easy to accomplish.

Obviously, the type of critical thinking extensions offered varied according to the developmental level of each class. Preschool students participated in role playing activities that encouraged critical thought, were instructed in the task of various methods of formulating answers to word problems and participated in creative exercises that were designed to promote responses that utilized higher level thinking strategies. Even at the preschool level, participation was encouraged and the students were offered opportunities to utilize higher level thinking on a daily basis. For the slightly older children, a “daily critical thinking exercise” with follow up review as a class was utilized at the lower elementary level (six to nine year old students) in an effort to effectively gauge student achievement through the nine week period at this level and encourage confidence. The lower elementary children also participated in word problems, making literature, science and writing connections and in having the staff “model” in lessons how to generate thoughtful, relevant and accurate responses through problem solving in a variety of methods. Upper elementary and middle school students experienced more traditionally measurable progress through the written assessments already in place but the staff still supplemented the existing work with critical thinking opportunities each day. Upper elementary data included weekly science experiments, Junior Great Books and relevant literature and writing discussions that prompted thoughtful participation, and other reading through read-a-loud opportunities such as character analysis, character judgments, theme, plot analysis and summarization activities. At the middle school level, the students were held to an even higher standard with activities involving the

interpretation of political cartoons, using chronology and timelines to make inferences, relating global concerns to human's responsibilities on earth and of course, in the areas of math with complex algebraic, geometry and word problems involving several applications and computations, as well as the challenge of making inferences and predictions. As with the older elementary students, the middle school program's measured progress was traditionally measured through regular testing and grading that was already in place as part of the school's culture. A comprehensive list of the interventions at each developmental level is provided in the Appendix.

Because the preliminary research also pointed to the benefit of teachers modeling critical thinking aloud, this was also integrated at all levels, as well as the exploration of the relationship between creativity and cooperative learning that would lead to higher level thinking improvements. The staff also focused on developing confidence in the students and encouraging responses in whole group, small group and individual lessons. Preschool teachers focused on encouraging relevant responses from the children that reflected a consistent train of thought and answer to the questions posed. As one might imagine, the Montessori classrooms were well equipped with an already existing springboard for the critical thinking exercises and the staff commented on the ease of incorporating these extensions throughout the day.

Data was collected throughout the nine week period and evaluated at the end of the nine week implementation through four methods: observational records, student work samples, interviews with staff and surveys, both before and after the nine week period of implementation. Observational records were kept by each individual teacher, as well as

the facilitator of the project, who is an administrator in the school. Student work samples were gathered and utilized. Additionally, the daily critical thinking problems for the six to nine year olds were assessed at the beginning of the project period, and again at the end. Pre-investigational and post-investigational surveys of the staff and students were also utilized to gauge the success of the project. The staff also kept observational records notating the amount of confidence the children exhibited in answering that was measured by the number of children raising their hands to respond. Using these four methods of data collection, there was ample quantitative and qualitative information to decipher and as will be illustrated, the data indicates overall improvement for the school at the end of the implementation period.

Analysis of Data

Interestingly, overall data analysis reflects that the implementation period improved participation, confidence and accurate responses for the students. Also, the analysis of the data indicates that the research noting “teacher interactions and expectations contribute to a student’s achievement regarding critical thinking opportunities” (Law & Kaufold, 2009, pg. 30) is accurate. It was also evidenced that throughout the implementation, the educators involved were more purposeful in their presentations regarding critical thinking and teacher expectations were improved; therefore, increasing student confidence and performance. Data was collected utilizing four mechanisms: observational records, student work samples, interviews, and surveys taken both before and after the implementation period.

As one of four methods of data collection, observations were made as an ongoing process throughout the study. Observational records were maintained by both the educators implementing the plan in their classrooms and with the school administrator, who formally and informally, observed various critical thinking lessons throughout the process. As a snapshot of performance data, let us examine the process from one observational record made on the first day of implementation, January 25, 2010, and create a comparison with a day near the end of the implementation period, March 8, 2010, in one elementary classroom. In this particular classroom, throughout the implementation period, and on these days, the teacher presented a critical thinking exercise that involved the entire class' participation. Five critical thinking problems were presented on the classroom smart board and the students were asked to attempt to solve the problems on their own. After the class finished, the teacher led a discussion about the various methods that could be utilized to solve the problems, encouraging responses from the students. Additionally, the work for each student was submitted at the end of the session and the student's original responses were recorded. The information below provides a comparison and indicates an overall improvement, in both confidence from the learners and in their abilities, after the implementation:

Table 1: Comparison of Critical Thinking Improvements and Responses in one Classroom (Elementary)

January 25,2010 (beginning of implementation)	23.5% Participated	23.5% Had 100% accuracy with work
March 8, 2010 (end of implementation)	37.6% Participated	37.6% Had 100% accuracy with work

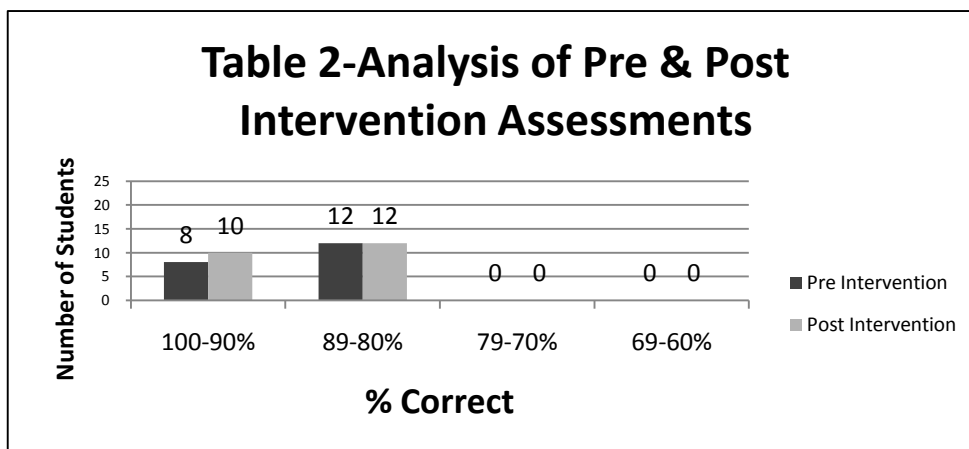
Note: The percentages do not indicate the same students. Not all students who participated had accurate answers.

Given the fact that this improvement was shown for this particular class during the intervention period, one could assume that the intervention was successful in other classrooms of students affected during the implementation period of this same age and composition. Other observations also indicate willingness from the students to attempt to solve critical thinking problems independently. For example, one sampling of data from an elementary class showed an overall improvement in student's interest in providing responses. An activity offered the second week of the intervention indicates 14% of the students did not attempt to solve all the problems offered, while after the intervention, only one child did not attempt all the problems presented.

At the younger elementary age, observations also indicate that student confidence and accuracy improves with daily instruction in critical thinking strategies. The students were offered sample activities daily and creative exploration of problem computation was formally taught and encouraged. Because pre-investigation data indicated a lower ability from students tested in standardized testing situations prior to the upper elementary age, the staff worked tirelessly to develop a systematic method of instruction on "how" to solve problems to this age group. With various abilities present in the Montessori six to nine year old aged group, students were encouraged to use various mechanisms at arriving at the accurate answer and to "show how they know" such as through illustrations, addition, multiplication or whatever strategy worked best for each child's individual learning level and/or computation. As the data gained from the observations

indicated, there was overall improvement in learner's accuracy and confidence at this level which could be a result of the actual teaching of constructive thinking techniques and showing the children that sometimes many different ways can be utilized to arrive at a correct solution.

Interestingly, student work samples also indicate data that reflects a slight improvement in ability to engage in critical thinking opportunities and in participation. For example, in another elementary classroom (E2), the students were given pre-intervention and post-intervention assessments. The results indicate an improvement after the intervention period and are noted below in Figure One, although the data reflects only a small increase in improvement. After reflection from the staff, an assumption could be made that there is a great deal of individual attention given at this developmental level in Montessori classrooms to ensure success and so perhaps there was not such a drastic difference between before and after the intervention because every effort was made to make the children successful with each activity, even before the implementation. Also, by offering this style of teaching problem solving, learners automatically improve in their confidence in responding to such matters. Also, one should note that learning at this grade level in a Montessori classroom involves more focus on the "process" of learning and less on the "product" and with teacher guidance available for the work itself, the difference in data would not be as drastic as one might surmise. Also, as evidenced in staff surveys, some children were not as mature as others, contributing to a smaller increase in their performance. Interestingly, this figure does illustrate some improvement and is illustrated below in Table Two:



Other analysis of student work samples indicate that by creating an atmosphere where learning and problem solving were fostered, that the students would consciously strive to solve problems utilizing whatever means they could rely on. For example, in one elementary classroom (E1), the students in one grade level were presented with the same problem and when provided with the freedom to solve the problem using whatever means they wished, it was interesting to note the varied methods utilized. The question posed in this sample was “A botanist planted 4 rows of flowers and each row, there were 7 flowers. How many were in all? Show how you know.” Of the 9 respondents, 3 of the students utilized pictures to solve the computation, 5 used addition and 2 used multiplication strategies. By using various strategies, having previous direct instruction in problem solving and developing in their confidence in responding, the group was able to, for the most part, correctly determine the accurate answer. Interestingly, student work samples and other data collection methods point to the validity of the research that the emphasis on critical thinking can positively influence learner outcomes, including

children in the younger grades. As further data is needed, let us now look at data derived from interviews with staff that also verify this statement.

Interviews with teaching staff were also utilized to identify the success of the intervention. Interviews with staff were accomplished as part of a regular staff meeting and also completed individually, in the event that the educators had opinions that would be better expressed privately. Although the analysis of observational data in the context of interviews is more subjective, several patterns did emerge in the interviews. For example, 100% of the educators participating noted general, overall improvement in confidence regarding the learners' desire to respond to critical thinking problems presented in the classroom. Even the preschool teachers reached consensus on the fact that although the younger children (aged three to five) had challenges in responding with the correct answers, that they were "better at thinking about what answers to give instead of saying random things." The preschool staff also concurred on the notion that "critical thinking is a type of thought that even three year olds can engage in"

(Willingham, 2008, pg. 22)

The preschool staff involved in the implementation also positively indicated post-intervention that these strategies could have been implemented in the school's toddler classroom. As a potential indicator, a preschool instructor who had been involved in the implementation worked on the addition of higher level thinking strategies separately with a selected group of younger, preschool students closer to the toddler age (age 2.5 to 3.4) in a specific lesson on size comparisons, constructing and applying knowledge. As an experiment, the instructor presented the children with varying sizes of pinecones and

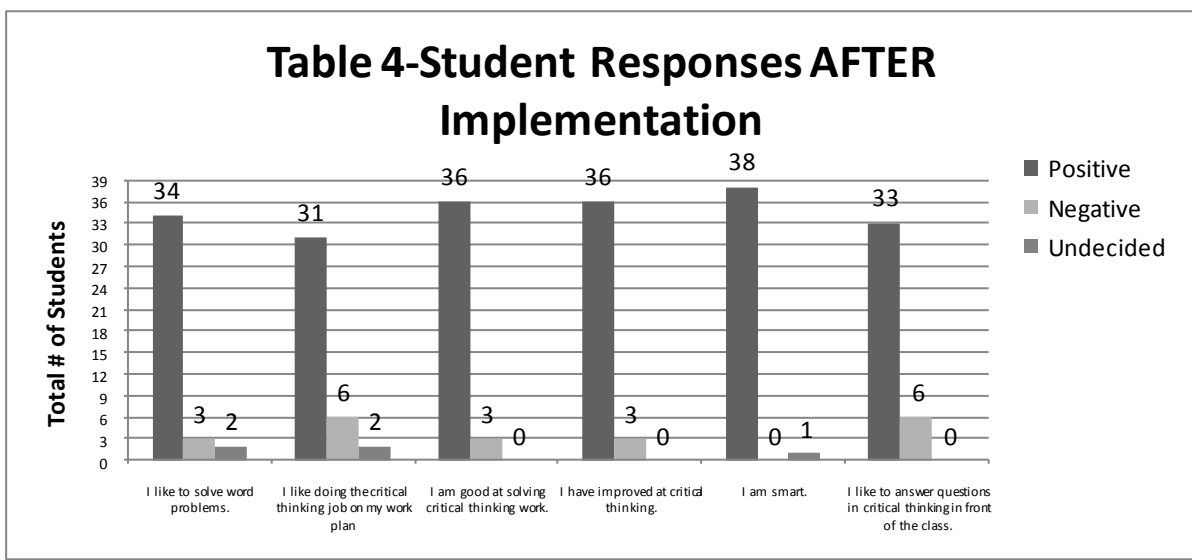
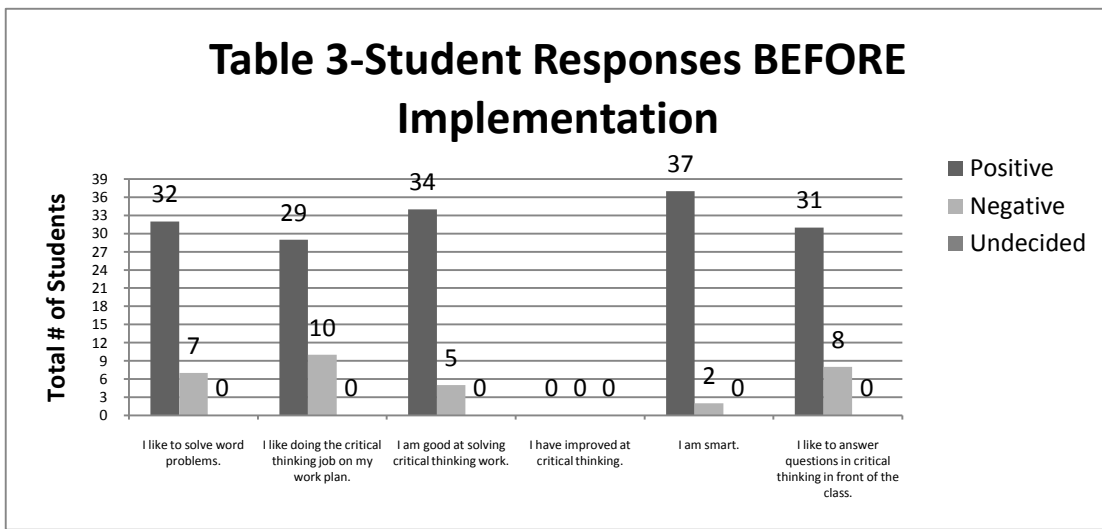
encouraged them to correctly match each with pictures of trees in corresponding sizes. Interestingly, of these very young learners, one half was able to distinguish and match the larger trees with the larger pinecones, medium pinecones with medium trees, and small trees with smaller pinecones. After further instruction in methods of deduction to complete the task, the student's abilities of this selected group improved again, with three-fourth of the group correctly matching the materials independently. Interestingly, prior to the implementation, the staff had reached a consensus through a group interview format that the toddlers should not participate in the school's critical thinking implementation; however, this post-investigation evaluation has now been determined inaccurate and as noted in the action plan, the school will begin to implement critical thinking instruction in the toddler class.

Lower elementary staff noted also throughout the interview process that the implementation increased student responses, confidence and independence in solving critical thinking word problems. One of the elementary classrooms of six to nine children (E1) notated that the students also functioned well in smaller groups to solve the problems, using cooperative learning techniques to problem solve as a group to positively influence the work, allowing for a higher level of accurate responses. Importantly, the staff also disclosed during the interview process the ease of adapting critical thinking into various subject matters and that through this study, the instruction of critical thinking became more habitual and easier to integrate. This confirmed previously examined research indicating that "critical thinking can be taught in combination with various subjects in an environment where curiosity is fostered and assertive expression is valued"

(Lodewyck, 2009, pg. 15) and was evidenced through the interviews conducted post-intervention.

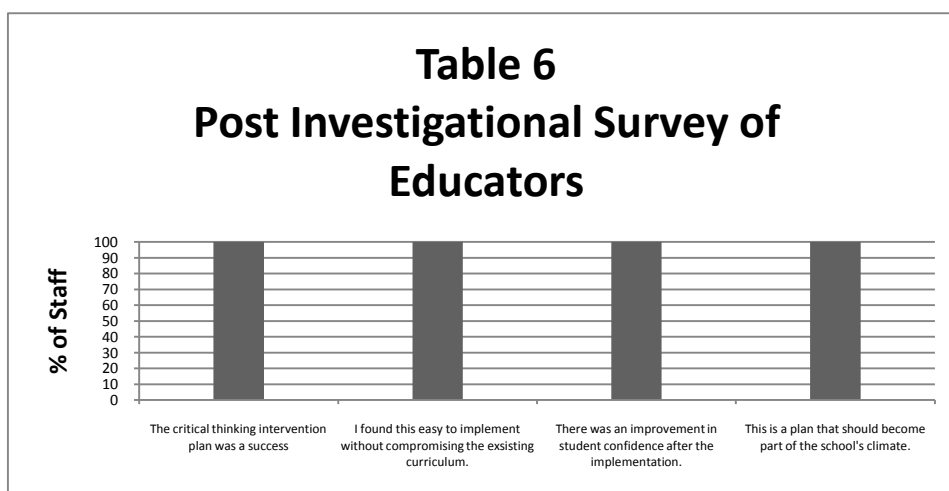
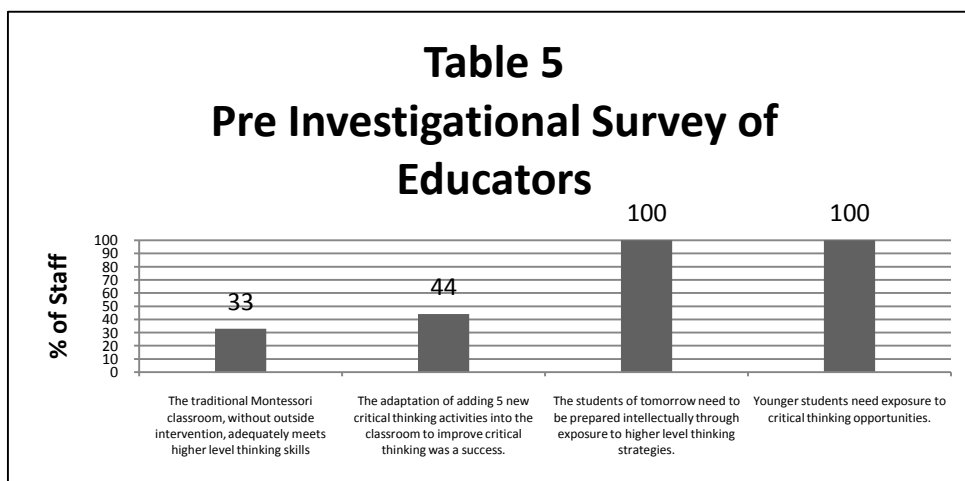
Also in regard to the interviews, the Montessori instructors unanimously agreed that an action plan that targeted critical thinking could produce positive outcomes in student performance and the staff was also in agreement that the intervention positively affected student's confidence. Overall, the staff noted that the children were better "thinkers" and even for the younger students, "more willing to try". As Montessori educators, a "willingness to try" and a "confidence" in the subject matter was extremely important to the staff in terms of the development of the *whole* child, a foundation of the Montessori teaching philosophy. The staff also noted that although there wasn't a drastic improvement in higher level thinking, that perhaps adopting a longer intervention period and analyzing standardized testing results annually would lead to increased success and a better framework of reference for comparative study and self-reflection.

Finally, pre-investigational and post-investigational surveys were also utilized to assess the effectiveness of the intervention plan. Surveys were utilized for two elementary classrooms (E1 and E2), involving students and staff. After evaluating the surveys for the students, the results indicate improvement in several areas that the children identified and show that the students involved in these two elementary (six to nine year old) classrooms viewed themselves more positively in their abilities to process higher level thinking *after* the implementation. Table 3 illustrates this below:



As noted above in Tables 3 and 4, student surveys indicate improvement in the student’s confidence, an integral part of Montessori education that addresses the “whole” child and one of the core principles of the school’s adopted teaching style.

As a comparison, staff surveys also indicate overall improvement in both performance based outcomes and in student confidence. Results from staff surveys are outlined below in Table 5:



One should also note that through teacher post-intervention surveys, that some challenges were identified in the implementation. Specifically, two of the nine educators surveyed noted maturity in some of the students as an obstacle for adequate growth and lack of confidence in some learners as an issue that could still be improved. Interestingly,

this evidenced itself at the lower elementary level (six to nine year old group) and the instructors of the older students did not identify this as an issue. With this information in the background, it does appear necessary to surmise that teachers of the younger children need to remember that they are building a foundation in the presentation of critical thinking and that strong academic success in these thought processes may not present itself until the child matures. Although this could be frustrating for those implementing the addition of higher level activities for younger learners, this could be remedied in the future by adding more professional development opportunities in this arena for the staff.

With the data collection process indicating that the implementation to improve critical thinking was generally a success, particularly in the confidence in the learners, let us now discuss the action plan that has been developed for the future within the school setting to ensure continuous improvement within this particular school and that could also be adapted in other institutions.

Action Plan

The question posed by the staff, “What effect will an action plan that targets critical thinking in a Montessori setting for preschool through middle school students have on the student’s ability to think constructively and utilize higher level thinking skills?” was evaluated and determined to be a success. Due to the nine week implementation, the staff involved accurately determined that direct instruction in utilizing higher level thinking skills is necessary and vital to increasing student

performance and confidence. Also, instituting continuing education for staff and increasing teacher expectation of the students is vital to the academic and intellectual preparation of the learners. Additionally, the staff was pleasantly surprised to find that integrating critical thinking across various subject matters and throughout each school day was easy to accomplish. The students also gained in their confidence and interest in responding and as the students participated more and increased in their abilities, the staff valued their efforts and embraced the importance of the intervention.

As a plan for the future is needed, the staff has identified several changes and adaptations to the critical thinking implementation that was instituted in this process. To begin, critical thinking extensions, lessons and instruction will continue and in fact, the instruction will broaden beyond the nine, core lead teachers involved in this study to include all support staff, such as assistants, aides, interns and specialty teachers. Involving the rest of the staff and a more thorough inclusion within all subject matters will effectively impact student performance and confidence. By extending participation and interest to the entire staff in the school, it is also expected that student performance will continue to improve. As noted, the initial study indicated that an emphasis on this via instruction, continuing education and staff expectations would directly contribute to the performance of the learners and also influence the children's confidence in this area. To be concise, by embracing critical thinking extensions in every aspect of the school, the staff eagerly anticipates further improvement. Also, it has been discussed to include the toddler program with future intervention strategies. The increased performance at the preschool level, along with the need to implement a stronger foundation in this area,

would indicate that critical thinking extensions in the toddler program are possible, although obviously they will be offered specific to each child's developmental level.

The staff has also targeted the importance of encouraging confidence within the students in responding to higher level thinking presentations. As a Montessori school and in working with over half of the students under the age of nine, the importance of encouragement and practice, while instilling confidence in responding, is vital to a successful foundation for later academic success. The staff felt inspired by the effectiveness of the intervention in encouraging learner response and notated this as the primary success of the intervention. As Montessori guides, it becomes vital to create (and maintain) an atmosphere that encourages learners to attempt new tasks and with confidence; the intervention proved that this could be accomplished through continued development in the integration of the higher level thinking implementation.

Additionally, the need for an ongoing process of continuing education becomes necessary. As noted, research indicates that continuing education for staff on current strategies for education implementation in this area must include professional development. As one might imagine, it will also be important to provide continuing education opportunities for the teachers that have not already been involved. Integrating critical thinking in music education, art instruction, physical education and even in technology should be a central focus for the future that will ensure continued success. By instructing new staff in the mechanics of the instruction of critical thinking into the existent programming, the research plan data indicates that this should also lead to continual improvement.

The staff and administration are also interested in charting standardized test results at the end of this school year and comparing them with the last several years' results. As an accredited school, the educators are already charged with the task of continually evaluating and documenting positive and negative results in a continuous improvement cycle and so continuing to analyze each student's ability to think abstractly through the standardized testing routine already in place provides validity to the study and influences future action. With the last two years of testing results already in place, the annual process of comparing the student's performance in this area should be fairly easy to implement. This task will be completed each summer by the school administrator and as the school meets annually to chart and discuss the standardized test results, this addition can easily transition into the school's climate.

Overall, the school will continue to adapt the inclusion of critical thinking into its programming and looks forward to continuing to monitor the positive results. With student confidence improved, as well as the abilities of the learners to participate in higher level thinking strategies, the intervention was successful and will certainly become an ongoing process in the life of the school.

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Appendix
Examples of Activities and Interventions/Critical Thinking

1. Primary Level (3 classrooms of 3-6 year olds)
 - a. Date and Time Game
 - b. Critical Thinking Word Problems-illustrations to solve
 - c. Role-playing games
 - d. Cooperative Learning Activities
 - e. Creativity as an outlet to foster critical thinking
 - f. Picture Stories
 - g. Plot Summarization and Character Analysis through Read a Loud activities
 - h. Science Experiments with introduction to the scientific process
 - i. Caldecott Literature with extensions
 - j. Guided Research
 - k. Writing a Summary

2. Lower Elementary Level (2 classrooms of 6-9 year olds)
 - a. Daily Critical Thinking Problems with teacher following up orally on various methods to solve
 - b. Introduction of Analogies and Practice
 - c. Cooperative Learning with Critical Thinking Exercises as a Group to Solve
 - d. Timelines of Life/Interpretations and Synthesis of Information
 - e. Homework Exercises weekly to reinforce higher level thinking
 - f. Elapsed Time Calculation exercises
 - g. 2 and 3 step word problems, levels dependent on developmental needs of students
 - h. Sequencing Events and Sentences to create timelines or paragraphs
 - i. Guided Research Activities
 - j. Summarizing Events, Plot Analysis and Character Analysis with Read a loud and Junior Great Books
 - k. Rebus Puzzles
 - l. Math Constructivist Games
 - m. Riddles
 - n. Listening comprehension activities
 - o. Comparison and Contrast Activities with Venn Diagrams

3. Upper Elementary Level (1 classroom of 9-12 year olds)
 - a. Daily Critical Thinking Problems with teacher following up orally on various methods to solve
 - b. Analogies and Practice
 - c. Cooperative Learning with Critical Thinking Exercises as a Group to Solve
 - d. Timelines of Life/Interpretations and Synthesis of Information
 - e. Homework Exercises weekly to reinforce higher level thinking
 - f. Elapsed Time Calculation exercises

- g. 2 and 3 step world problems, levels dependent on developmental needs of students
 - h. Sequencing Events and Sentences to create timelines or paragraphs
 - i. Guided Research Activities
 - j. Summarizing Events, Plot Analysis and Character Analysis with Read a loud and Junior Great Books
 - k. Critical Thinking Puzzles
 - l. Math Constructivist Games
 - m. Riddles
 - n. Listening comprehension activities
 - o. Comparison and Contrast Activities with Venn Diagrams
 - p. Scientific Method to introduce and practice higher level thinking
 - q. Hands on Algebra
 - r. Advanced Geometry Practice w/ word problems
 - s. Persuasive Writing
4. Middle School (one classroom of 7th and 8th grade, 12-14 years old)
- A. Advanced Analogies and Practice
 - B. Cooperative Learning with Critical Thinking Exercises as a Group to Solve
 - C. Timelines of Life/Interpretations and Synthesis of Information
 - D. Homework Exercises weekly to reinforce higher level thinking
 - E. 3 step world problems, levels dependent on developmental needs of students
 - F. Sequencing Events and Sentences to create timelines or paragraphs
 - G. Research Activities
 - H. Summarizing Events, Plot and Character Analysis
 - I. Listening comprehension activities
 - J. Comparison and Contrast Writing Assignments
 - K. Science-various activities integrating the synthesis of knowledge
 - L. Algebra and Pre-Algebra (translation of sentences into equations, inequalities or formulas)
 - M. Advanced Geometry Practice w/ word problems
 - N. Persuasive Writing
 - O. Interpretation of Political Cartoons and other Civics Exercises
 - P. Technology Work-Computers
 - Q. Determining Errors