Using Reflection to Develop Higher Order Processes

Carol Lerch
Daniel Webster College
Nashua, NH 03063
lerch@dwc.edu

Andrea Bilics
Worcester State College
Worcester, MA 01612
abilics@worcester.edu

Binta Colley
American University
Washington DC 20016
binta@cox.net

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The ability to think critically is an important trait of all members of society. With today's multinational, multicultural, complex issues, citizens must be able to sift through large amounts of various data to make intelligent decisions. According to Leibowitz (1997) "complex thinking, communication and collaboration will be among the essential process areas for the world as we will know it" (p. 50). Higher education must provide the intellectual training for its students to participate in this world.

Purpose

The main purpose of this study was to look at how we used specific writing assignments in our courses to encourage metacognitive reflection in order to increase the learning that takes place. This study also aimed to aid in the development of higher order processing skills through the development of student reflection. We have focused on Marzano's (2001) three systems of knowledge processing: self-system thinking, metacognition and cognitive system. The cognitive system is subdivided into retrieval, comprehension, analysis, and knowledge utilization.

Theoretical Framework

Vygotsky (1978) noted that for "the adolescent, to recall means to think" (p.51).We contend that for college students thinking should also mean reflection. According to Mezirow (1990) reflection is used "to examine the justification for one's beliefs … and to reassess the efficacy of the strategies and procedures used in problem solving" (p. xvi). Critical thinking is a result of reflecting on one's learning and developing a "meta-awareness by reflecting on one's thoughts, feelings and actions" (Taylor 1992). The students need to transform their learning through critical self-reflection (Mezirow 1990). We agree that learning takes place in an environment of thinking and reflecting, of connecting the old to the new.

Kozulin, in his introduction to *Thought and Language* (Vygotsky 1986), recalled that Vygotsky "perceived psychological development as a dynamic process full of upheavals, sudden changes, and reversals" (p. xxix), a process that requires the learner to stop and reflect. As educators we must introduce the process of reflection to the academic environment through various means. Since "reflection is both an individual and shared

experience" (Mewborn 1999), in this study we used multiple writing prompts to identify students' understanding of themselves as learners.

Inquiry Methods

The research methodology used in this study is educational action research and classroom research (Angelo 1991) which provide a rationale for studying our own teaching and learning as well as the students' learning. Part of effective teaching is the ability to reflect on what is happening in the classroom, and to identify any differences in what was planned and what actually occurred. By conducting "systematic, intentional inquiry" (Cochran-Smith and Lytle 1993) within her own classroom, the instructor builds a better understanding of her own practice. As this understanding develops, different teaching strategies may be suggested to better support student learning. Action research, as defined by Elliott (1991) is "the study of a social situation with a view to improving the quality of action with it" (p. 69), implying that a change in the situation under study develops out of the research itself by drawing together both research and practice (Carson 1990). When pursuing an idea that arises from professional practice, the teacher is enacting upon a personal theory that has been developed over time (McCutcheon and Jung 1990).

This study reflects a cross-cultural base: urban residential college with a diverse student population, suburban residential college with traditional age students, and state college graduate and undergraduate students. In addition, the researchers represent both African American and white faculty and teach courses in mathematics, teacher education, and professional entry-level occupational therapy.

The following research questions guided this study:

1. How do we use reflection to scaffold students' learning and the development of higher level processing skills?
2. How do students use reflection to scaffold their own learning and develop higher level processing skills?

Data Sources

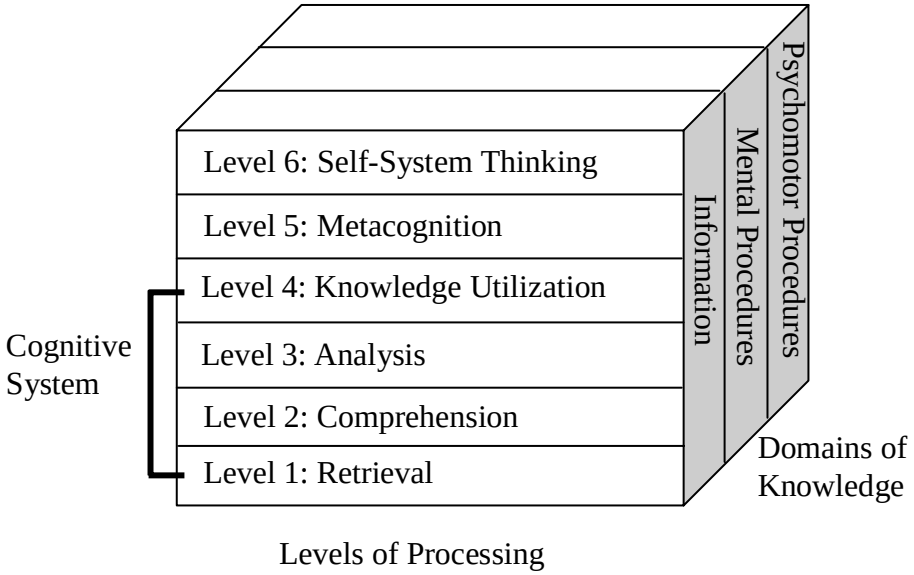
Data sources included students' writings in the following courses: college algebra, history and philosophy of education, theories of occupational therapy, community health issues, and research. Writing can be used in two ways: as a means of communication and as a learning tool. Writing communicates one's thoughts, ideas and knowledge to oneself as well

as to others (Gage, 1986; Zinsser, 1988). As a learning tool, writing helps students make knowledge their own by putting concepts into their own words (Mayher & Lester, 1983). The written evidence becomes a tool that both the students and the teacher may use to understand the thought processes involved in understanding the new concepts presented in the lessons.

The writing assignments varied in scope from course to course. (The various prompts are presented in the Appendix A.) For example, in College Algebra the writing focused student attention on their perceptions of themselves as learners and their progress through the course. In School and Society, the writings focused on analysis of the readings presented during the semester. The assignments (see Appendix B) included writings and surveys. In Theories of Occupational Therapy students were expected to answer specific questions about the each week's readings (see Appendix C). In Advanced Group Theories the reflections asked students to reflect on their own experiences, strengths, and weaknesses in relation to class content (see Appendix D).

Analysis

Using Marzano's New Taxonomy (2001), we analyzed the data to identify how students' thinking has developed over time. Marzano's New Taxonomy provides a two-dimensional model of thinking. One dimension consists of three knowledge domains, information, mental procedures, and psychomotor procedures. Information, also identified as declarative knowledge, is composed of details and organizing ideas. Mental procedures are the "how-to" knowledge. Psychomotor procedures are the physical actions that people learn in order to engage in their environment. They consist of processes and skills. The domains are not hierarchical.



(Marzano, 2001, p. 60)

Figure 1. Marzano's Two-Dimensional Model of Knowledge

The second dimension of the New Taxonomy incorporates three systems of thought, the self-system, the metacognitive system, and the cognitive system. The cognitive system consists of knowledge utilization, analysis, comprehension, and retrieval. This hierarchical dimension of human thought interacts with each of the domains of knowledge. This model provided us with an analytical tool to understand the changes in students' and our own thinking that are the result of the scaffolding the reflections provide the learner.

Importance of the Study

Learning is enhanced by critical reflection, which involves the "creation of meaning and conceptualization from experience" (Brockbank and McGill 1998). As educators we need to facilitate critical reflection to enable students to move beyond a superficial understanding of their world. We agree with Mezirow (1990) that "reflection enables us to correct distortions in our beliefs and errors in problem solving. Critical reflection involves a critique of the presuppositions on which our beliefs have been built" (p.1). The world is becoming more and more complex, and by creating a reflective environment for and with students, the educational experience will lay the foundations of a critically reflective member of the world community.

Findings

Our findings are presented in three sections, each dealing with a specific author. We are involved with varied student backgrounds and have used different writing prompts to focus student attention on specific components of the Marzano model (Figure 1). The first section presents the findings from College Algebra. The writings used in the mathematics course involved self-system thinking and metacognition. The purpose was to focus student attention on their prior learning and the changes that they needed to accomplish throughout the semester. According to Marzano (2001) "the self system consists of an interrelated system of attitudes, beliefs, and emotions. It is the interaction of these attitudes, beliefs, and emotions that determines both motivation and attention" (p. 50), while level five, metacognition, involves setting goals and making specific plans for the semester. It is to these specific purposes that the writing assignments in College Algebra were targeted. Students who feel they cannot do math will inevitably fulfill that prophecy, while students who will allow the door to open a crack and admit that they might be able to accomplish the tasks in the course, will have more chance of success. As Marzano further stated "the self-system determines whether an individual will engage in or disengage in a given task; it also determines how much energy the individual will bring to the task" (p. 50).

The second section involves the analysis of the writings from Schools and Society, an education course. The writings used in this course were used to analyze the reading assignments integral to the course. Discussion threads were also used on Blackboard to relate their own learning through discussion of prior learning and new content. These writing reflections focused on Marzano's level three, Analysis, which involves "examining knowledge in fine detail and, as a result, generating new conclusions" (p. 71).

The third section involves the material from the occupational therapy coursework. In Theories of Occupational Therapy the weekly questions were intended to have the students engage with the assigned readings and relate those readings to their previous learning. The questions primarily generated thinking at the retrieval, comprehension, and analysis levels, though some students demonstrated some knowledge utilization. Marzano (2001) describes retrieval as "the simple recall or execution of knowledge" (p. 59) and comprehension as "the identification and representation of the more important versus less important aspects of that knowledge" (p. 64). Knowledge utilization "requires that students apply or use knowledge in specific situations" (p. 83). These four levels, retrieval, comprehension, analysis and knowledge utilization, make up the cognitive system. In Advanced Group Theories the reflections were intended to increase students' self awareness and to identify personal goals and action plans, self system and metacognitive thinking.

Findings – Segment I

The College Algebra students involved in this study are mostly first year college students who have been placed into the course through an in-house placement exam or have passed the non-credit introductory algebra course. They come to the class with a set of knowledge about algebra that is incomplete and in some cases incorrect. In a very short time, approximately thirty class hours, the students must change as well as increase their knowledge base. To this end, I developed a series of reflective assignments that attempt to focus the students on this difficult task of changing what has already been learned.

The first writing is a mathematical autobiography (see Appendix A for the prompt). The students were asked to reflect on their previous mathematical history and to set goals for the algebra course. More importantly, they were asked to identify how they will achieve those goals, what steps they will take to ensure their success, thus signaling the metacognitive system to engage. It is the metacognitive system that is "responsible for the effective processing of the information that is essential to completion of the task" (Marzano 2001). Each subsequent writing assignment returns the student to these goals to reflect on their progress.

Generally the students say they want to do well in the course and say they will work hard. As Marzano (2001) states, this is not sufficient to engage the metacognitive level. Setting goals is a difficult concept for many students and many do not on the first try. On Jimmy's first draft he did not get specific and I suggested he rewrite the essay to include goals. In response to the following comments

> [Jimmy], you have given me a good picture of your mathematical history. You did not articulate your goals for this semester, nor did you identify how you would achieve them. I think this is very important, so I will give you the opportunity to rewrite this essay and include that material.

He did rewrite his essay and showed more depth of thought.

> Some things I would like to achieve this semester in mathematics are that I would like to reinforce my basic algebra skills. I believe that retaking some of these lessons will make sure that I understand how to perform mathematics properly. Also, retaking algebra will give me a chance to catch up on anything that I may have struggled with

> or missed in previous algebra courses. Another goal of mine is to achieve an A- as my grade for the semester. I will achieve this by answering as many JIT questions, doing all of my homework, and studying more than enough to succeed on the exams. Finally, and easiest of all, I believe that attending every class is the first step in achieving this goal. Without being in class, it is much more difficult to learn what is going on.

Jimmy also exhibited what Marzano (2001) calls "self-system thinking." He was identifying why this learning was important when stating

> It's difficult to learn mathematics without applying it, and the best place to apply it is in the classroom. … I believe that algebra is very important in order to become a pilot, engineer, or almost any other career choice that I may take on. On a broader scale, I hope to be able to balance my effort in mathematics throughout every other course I am taking this semester.

Jimmy was identifying the importance of the algebra class for himself and was providing a level of motivation that he needed to work throughout the semester.

It is generally on the second writing assignment (see Appendix A for the prompt) that the students realize that they have to take responsibility for their learning. After their first test was returned the students were asked to reflect on their progress to date and whether they are doing what they said they would. As Henry said

> My goals are slowly taking effect but I need to give them a little boost so I can really kick it up a notch. I want to do better on tests and shoot for A's, I want to understand the material better and study harder to achieve those A's, and I want to do well in the class overall. …. These are the goals I have set for myself, and as you can see I also made new goals for myself to strive for success. These goals will help me become a better student and also a better person in general.

Many students identify specific areas of difficulty they have. The most common include rushing through tests, not asking for help, and not doing homework. Harry wrote in his second essay "I have just added a new goal though. This new goal is to check my work more carefully. All in all I need to break old habits by paying more attention to what I'm

doing instead of concentrating on the problems first." Many identify specific processes that they have had trouble with in the past. Jerry seemed to be thinking on this level when he wrote that "filling in these holes that may be big as the one that sank the Lusitanian [sic], are necessary before I return to calculus."

Marzano's theory also calls for a "level of consciousness" (p. 13) in the student in order to learn. Emotional responses are part of what we bring to every learning situation, and should be brought to the surface and examined. One of the tasks in the autobiography is to relate both positive and negative stories. It is important to identify how the student feels about mathematics and take a look at how that interferes with their progress. Brockbank and McGill (1998) stated that "the context of learning and what the learner perceives, consciously or not, as the ability to think, feel and act in any situation is crucial to the means by which that person becomes a transformational learner" (p. 4). Identifying the emotional aspects of learning is done through reflection and self thinking. Many students see themselves as not able to learn mathematics, an emotion that if allowed to remain would provide a self-fulfilling prophecy. One of the many goals of the reflection essays is to bring to light the students' emotional response to the subject. As the reader can assume, there are far more negative than positive responses. By brining these to light, the student is more able to change these feelings through positive experiences with the subject. Comments on the course evaluations highlighted how some students were able to change their emotional response to mathematics. Many students stated "I finally like math," far more than I have seen in the past.

Findings - Segment II

The students in the Schools and Society course range from Freshmen to Juniors, with the majority at the freshman-sophomore level. Ethnically the majority of the thirty students are white, with four African American students and two Latinas. This course is a requirement for education students and it is available as fulfillment of the general education course requirements. As a result, half of the students are general education students and the others are education majors. The reflective activities in this course are built into the reading assignments, discussion boards, and three learning surveys spaced every five weeks during the semester.

The reading reflections asked students to respond to the same four prompts (see Appendix B) for all of the readings, and each time to make connections to previous knowledge and experiences and also to the resources and information previously discussed. Each Discussion Board (BlackBoard) was based on a reading or video and expanded upon during class discussions. Finally in the Learning Surveys (See Appendix B), students were given the opportunity to connect the resources to what they learned, what they already knew, what they found helpful, especially in the use of BlackBoard. This process was put in place to help the students think about their own learning process (metacognate) and also to retain ideas in a way that allowed for those ideas to be used to guide new learning (Moon, 2004).

The first reflective activity was the reading reflection in which students responded to the prompts of Observation, Connections, Surprises and Questions. Their questions were used as discussion in the class that followed, which again reinforced the reflective process. The Observation comment is usually at the analysis level, or as Marzano (2001) states: "…it involves the 'reasoned' extension of knowledge (p.38)." In the following response, Margaret exhibits some error analysis which "…involves (a) consciously judging the validity of knowledge based on explicit criteria and (b) identifying any errors in reasoning that have been presented" (p. 39).

> While other racial/ethnic groups were mentioned briefly in both the Kozol chapter and the article, I felt that more attention could have been paid to the integration of other minority groups. Neither inner city nor suburban schools consist entirely of Caucasian, African American and Latino students. Recent immigrants from countries across the world are experiencing similar disadvantage in the education system, and I am curious how that intersects wit the problems being discussed in these readings.

The "error" identified is what she sees as a failing of the readings to consider other variables. Her questions, based on the same reading move her toward knowledge utilization. Here she is responding to the prompt for Questions:

> What is the solution to a segregated education system? A large part of the problem is housing segregation, so to fully integrate it would require a majority of students to travel great distances to school each day. Kozol does address the fact that segregated schools cannot be entirely blamed on residential segregation, but I think that the housing issues must be addressed first.

In the above example, Margaret asks the question and then provides her solution which was not only based on the reading, but also on what she has determined to be a rational response based on the information she has been given. Many students exhibited a similar synthesis of information and it was interesting when they completed the Learning Survey that the very subject they wrote about so clearly was the topic that was new to them. When asked to list information that was new to them, half of the responses were similar to the ones below:

> More in depth look at segregation.
>
> I knew about segregation, but I did not realize how segregated the schools in the U.S. were.
>
> I also learned how segregation still affects our schools systems.
>
> The Kozol reading, especially regarding the extent to which public schools are still segregated.

Given the ethnic makeup of the class and the emotional content of the reading represented here, it is important to add that there is an emotional level to the learning that has less to do with consciousness and development and more to do with internal feelings. Reading responses were neutral across the board, but the class discussion was heated and rules of engagement had to be agreed upon – built on the idea of respect. Through in-class discussion much of the anger, frustration, guilt and surprise was dissipated, which I feel allowed for a more level response in the reading reflection. Moon (2005) acknowledges that feelings are part of the internal process that impact learning. Here is where Marzano's (2001) level of consciousness comes into play in terms of moving beyond the emotional response and onto a flow of information through the other knowledge domains.

It was not the African American nor the Latina students who pointed fingers of blame at White society for the inequity of public education, but it was the White students themselves that pointed out that change needed to take place within their own communities, families and individuals before wider changes could be expected. Working through this particular topic was made easier through the use of reflection on the readings, the discussion board, and the learning survey. Not all students responded positively to the questions, some ignored the topic discussed in the readings all together and focused on earlier readings. In general however, most of the students found the discussion board and class discussions helpful, especially since they were linked.

Findings – Segment III

The data used in this segment are from an undergraduate, online course on the theories used in occupational therapy practice. It is taught in the summer for post baccalaureate students entering the program of study, advanced undergraduate transfer students, and undergraduate students who are repeating the course. It is scheduled over both summer sessions. Most of the students in the course are also taking one or two other courses each summer session. It was the first time the course had been offered online or in the summer.

During the course, the students were expected to submit a guided reflection about each week's readings. They were to address the following four questions in each reflection:

1. What did you learn?
2. How does it fit with what you already knew?
3. How does it fit with occupational therapy?
4. What new questions did the reading generate?

The range of different levels of processing was evident even for a specific student. For example, in the first reflection submitted, after reading material examining theory, what it is, what it does, and how it is used in practice, Mary wrote:

> Before reading the assigned materials I knew that a theory was a concept that people base their future knowledge on. I did not know how often theories are really used and why they are so important. Professional identity in any field is based upon their founding theories and their up and coming ideas. This is why professional identity can be forever changing and why people under the same broad category can believe in two totally different ways of working.

Initially, her thinking is indicative of retrieval level, specifically recall. She is just recalling information details, no organizing ideas. Her reflection continues to indicate this level of thinking until near the end when she wrote:

> A few key points that a therapist must always remember to use in their practice is always have the clients well being in mind, address the problems that impact the client, and the therapist must use occupation as the primary source of therapy.

Here we see evidence of comprehension, specifically synthesis. She is organizing key characteristics.

Over the next few weeks Mary's writing continued to indicate primarily retrieval and comprehension levels of processing. Yet, when she shared the questions the readings had generated these questions were often focused on a knowledge utilization level of processing. For example, the third week of class was focused on the organization of occupational therapy's knowledge. Readings had discussed paradigms, conceptual practice models or frames of reference, and related knowledge. Students generally struggle just to understand these concepts and do not think about how they apply to practice, yet Mary's questions were:

> How does the therapist transition from one paradigm to the next as they change? After practicing with one for so long I can't see how changing over to another would be an easy feat. The values of the client and the therapist probably are not the same. How does the therapist treat a person whose values totally contradict those of her own?

Mary was beginning to think at the knowledge utilization level, about how to use this knowledge in practice. "Knowledge utilization processes are those that individuals employ when they wish to accomplish a specific task" (Marzano, 2001, p. 45). While Mary did not have a full understanding of the information, that is the details and organizing ideas of the material presented in the readings, and most likely would have difficulties making decisions to solve specific problems working with clients, her reflection indicates that she was starting to think about the information at a different level. She was beginning to ask about how therapists use their knowledge in real life settings.

Other students' reflections indicated different levels of thinking. The readings on the organization of occupational therapy's knowledge had also discussed how the paradigm had changed over time and was still changing. Ellen wrote:

> …a major component of what I had learned about the mechanistic paradigm was enlightening, not necessarily in a good way. Even though I had already known that at some point in time the focus of occupational therapy had changed to a more medical perspective, I never imagined that this change was so dramatic, to the point of occupational therapy becoming nonexistent…I understand now how this change has proved to be of some help in shaping the contemporary paradigm, but the shock was

> more due to the fact that I cannot come to terms with how a field loses its primary focus for the sake of criticism.

In these comments we see her struggling with what she is learning through her analysis. "Analysis involves the 'reasoned' extension of knowledge" (Marzano, 2001, p. 38). She has examined the paradigms, matching what she is learning with what she knows, identifying errors, and questioning the information's validity. She concludes the reflection with her questions:

> …knowing the impact that other disciplines have had on occupational therapy's paradigm, what is the likelihood that this may occur again and why? It terrifies me to think that my decision to want to become an occupational therapist is based on the contemporary paradigm and the fact that if it were to change as dramatically as it did in the past, I would be left with the question of "Where do I go from here?"

Here Ellen is engaging in self-system thinking. She is examining her emotional response to the possibility that occupational therapy might become a profession in which she does not want to practice. It was unusual to see this type of thinking in the reflections in this course since the questions tended to focus the students toward the cognitive levels of processing. Yet her self-system thinking results in Ellen engaging in metacognitive thinking when she states:

> …knowing the path which occupational therapy has followed provides insight into the importance of making sure the field of occupational therapy will never again be jeopardized. It is essential to stay focused on who we are, what our goals are, and how we will get there.

Ellen's examination of her emotional responses along with other self-system thinking allows her to engage the metacognitive thinking to identify goals.

In contrast to the theory course, the Advanced Group Theories course had frequent reflections asking the students to examine themselves, who they were. Reflections were structured to have them examine themselves in specific experiences and then to set goals and action plans. Generally, the reflections were related to material that was being used in classes so they had some information to organize their thinking. The first reflection asked students to examine themselves as a group person, to look at a positive and a negative group experience, to set both personal and academic goals, and to identify specific actions to take to meet those

goals. These reflections primarily revealed self-system and metacognitive thinking. Susan's reflection shows metacognitive thinking when she wrote:

> In a recent semester I had the opportunity to work with a particular classmate in almost every group I was in. This individual has a very strong personality and a habit of procrastinating. I on the other had am only strong when forced and then I become almost uncompromising. In addition, I have a type one personality; therefore I like to work on projects right away so it does not seem so overwhelming. As one might guess, as the semester went on groups became stressful and difficult. Our personalities clashed and the friendship was affected. We had a hard time completing projects and I was not pleased with our results. From that group, I was able to discern that my assertiveness and communication skills need work and also that I need to present with less obsessive compulsive qualities. The group partnership has taught me some weaknesses that should be given attention.

Here we see a student monitoring a process in which she engaged a metacognitive level of processing. By the end she is thinking at the self system level when she is examining her efficacy in the specific situation. These examinations allow her to develop a sense of her motivation and then to activate the metacognitive processes that will identify goals and actions, which she also identifies in the reflection.

At the end of the semester students were to reexamine themselves in relation to the goals from all the reflections during the semester. In the reflection the student returned to her interactions with that specific student. She writes:

> In regards to groups my goals were to become more assertive when dealing with difficult people, to pay attention to how I present myself to others, and to avoid shutting down during stressful group conflicts…The changes I saw were that for the most part I am now able to stick with the process even when the situation is intense as long as I remember to talk myself out of giving up and shutting down…I realize it sounds childish but as time goes on I am seeing more and more that adults have childish and pointless conflicts just as young people do. Knowing this and realizing how much stress the situation causes, I have tried to keep conflicts on the positive path and if that fails I do my best to keep my attitude optimistic.

Here we see Susan functioning at the self-system level. She is examining her efficacy, specifically the mental processes she uses to be effective in a situation. In addition, she is examining her emotional responses.

Summary

We have shared findings from several different types of courses and at both undergraduate and graduate levels. The prompts we used generated results at all the levels of thinking in Marzano's Taxonomy. Self-system thinking was seen in the College Algebra course and in Advanced Group Theories reflections. In those cases, the prompts were specifically intended to generate that type of thinking. Self-system thinking was also seen in Occupational Therapy Theories, though the prompts were not developed with that intention. In Schools and Society the prompts generated reflection that generated emotional responses when analyzing the reading material. The full range of the cognitive system was seen in the reflections from Occupational Therapy Theories.

We aimed to help our students become reflective learners through various writing assignments. Each course took a slightly different approach to the same goal. The different approaches related to the age of the students involved as well as the subject matter of the courses. Marzano's levels of knowledge processing gave us a framework with which to design writings that would begin the initiate the process of reflection in our students. We were concerned with two of the three domains of knowledge: information and mental procedures (Marzano, 2001, p. 60), while involving multiple levels of processing: retrieval, comprehension, analysis, knowledge utilization, metacognition, and self-system thinking. By targeting specific processing levels we were able to guide our students to work on specific tasks, such as error correction, goal setting, and looking at prior learning in new ways. Not only have we seen evidence of the various levels of thinking in the students' reflections, we have also begun to see evidence of higher level functioning as the courses progressed. Further study is necessary to more clearly understand any changes we are seeing.

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Appendix A

Writing # 1 - Mathematical Autobiography

Think about your mathematics courses over the years. Do particular people or incidents come to mind? Can you recall a positive experience concerning mathematics? How about a negative experience? How might these have had an effect on your approach to this course?

One purpose of this assignment is to open lines of communication between us that we will continue to build throughout the remainder of the semester. Another purpose is to ask you to reflect on how you feel about mathematics, and why you feel this way.

The assignment is also a record of your thoughts – something you can reflect on and learn from later. By reconstructing the events and processes by which you have arrived at this point, by identifying key events that have influenced you, you mat discover important aspects of your beliefs and skills, which could help you throughout the semester.

In this limited mathematical autobiography (2 to 3 pages), please include both a positive and a negative story. As part of your reflection, indicate how these events or people have influenced your perceptions of yourself as a mathematician.

Devote the final paragraph to a discussion of your goals for this course. Include the following: the reason you are taking this course, your personal goals that might be accomplished through this course, your academic goals for this course, and comments on how you will meet these goals. (We will return to these goals during the course of the semester.)

Writing #2 - Reflection Post First Test

Please look over your exam carefully. Pay careful attention to the errors you have made. Look for patterns on the types of errors – sign mistakes, copying incorrectly, concepts, wrong rules, etc. For instance, if you term chopped, is this something you have had trouble with in the past.

Think about how you prepared for this exam. Reread your autobiographies and comment on your stated goals and what you indicated you would do to reach those goals. Did you do what you said you needed to do? If not, reflect on why you did not do as you indicated and the impact, if any, your actions had on your test score. If you did not fulfill your goal for this test, but did what you indicated you should, what can you do next to insure a more successful result on the next test?

Reflection is the key to learning, especially to change mistaken processes. You were given a set of questions on the first day of class. How have you used these questions? Do they help focus your thoughts as you work on a problem? If you have not used them, discuss why not.

1. What (exactly) are you doing?
    - Can you describe it precisely?
2. Why are you doing it?
    - How does it fit into the solution?

3. How does it help you?
    - What will you do with the outcome when you obtain it?

Review your initial skill assessment. What errors did you make that are similar to the mistakes on the skills assessment? What errors did you correct from that assessment? What did you do to correct these errors?

Write a 2 page reflective essay.

The following are typical errors. Please add any others that are not listed. In your essay indicate which you made, then discuss what you will do to overcome these.

- ☐ Term chopping
- ☐ Sign mistakes
- ☐ Arithmetic errors
- ☐ Distribution sign error
- ☐ Calculator errors
- ☐ Copying incorrectly
- ☐ Exponent errors
- ☐ Factoring
- ☐ Procedure errors
- ☐ Order of operations
- ☐ Didn't check work
- ☐ Other errors - identify

Writing # 3 - Letter Home

Write a letter home to your parents explaining your grade at mid-semester. Please discuss how you are doing in College Algebra. Review your first essay and assess your progress toward your goals. Does your grade match your goals? If so, discuss what you have done to ensure your success. If not, discuss what you will do to improve your standing in this course. If you are receiving a warning, what would you say to your parents? [Your essay should be about 1 page.]

Writing # 4 - Semester End Preparation

The semester will be over soon. Reread your other 3 essays and think about how you have changed this semester. You set personal and academic goals that you were to work on during this course. It is time to reflect on your work toward both sets of goals. How has your approach to mathematics changed? How have you changed as a student? What new learning/study skills have you developed? What are your academic strengths? What are your academic weaknesses? How will you prepare for the final exam? Your essay should be 1-2 pages.

Appendix B

EDU – School and Society
Learning Survey

Please respond to the following questions regarding your learning in this course thus far.

1. Information that was new to me included the following:

_____
_____
_____
_____
_____

2. I already knew the following, and this course offered a review or update on the topic:

_____
_____
_____
_____
_____

3. Please list the Blackboard activities you found helpful in terms of your own learning and explain why or how they were helpful. If you found some Blackboard activities to not be helpful, list those and explain.

_____
_____
_____
_____
_____

4. Please describe any strategies we might adopt that you think will improve the course.

_____
_____
_____
_____
_____

5. Please list any criticisms you have – in a constructive way – that will allow for positive change.

_____
_____
_____

Appendix C

Group Autobiography

Think about your group experiences over the years. Do particular groups or incidents come to mind? Can you recall a positive experience involving groups? How about a negative experience? How might these have had an effect on your approach to this course?

One purpose of this assignment is to open lines of communication between us that we will continue to build throughout the remainder of the semester. Another purpose is to ask you to reflect on how you feel about groups, and why you feel this way.

The assignment is also a record of your thoughts – something you can reflect on and learn from later. By reconstructing the events and processes by which you have arrived at this point, by identifying key events that have influenced you, you may discover important aspects of your beliefs and skills, which could help you throughout the semester.

In this limited group autobiography (2 to 3 pages), please include both a positive and a negative story. As part of your reflection, indicate how these events or people have influenced your perceptions of yourself as a group person.

Devote the final paragraph to a discussion of your goals for this course. Include the following: the reason you are taking this course, your personal goals that might be accomplished through this course, your academic goals for this course, and comments on how you will meet these goals. (We will return to these goals during the course of the semester.)