

# SYMBOLIC INTERPRETATION STUDY

Symbolic Interpretation Study

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RES 1100B

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## SYMBOLIC INTERPRETATION STUDY

Abstract

For at least the last 40 years, the approach to teaching secondary mathematics has been virtually unchanged; quiz on old material, teach new material, practice new material, quiz on old material. While the methods on teaching the new material has changed, as well as the technology used, the approach is the same. At the same time, students are losing interest and, in turn, their standardized performances have also diminished. Secondary mathematics, as a result, is in need of being revamped. In the following study, a different approach to the opening 15 minutes is applied and tested whether the first 15 minutes can affect the rest of the learning process.

## SYMBOLIC INTERPRETATION STUDY

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### **Introduction**

The performance of secondary students is constantly under public criticism (Chappell, 2013). Despite the defense of some educators that old approaches still work (Hibbs, 2010), it is obvious to most observers that something needs to be changed. Through personal experiences and research, this author proposes in the following paper that these difficulties can be alleviated through the proper application of the basic concepts of teaching symbolically through dreams, song lyrics, poetry, and other avenues of metaphor.

The purpose of this study is to test the effectiveness of using a symbolic interpretation at the beginning of class on improving academic performance in a high school mathematics class. Although this study focuses on mathematics class, it is hoped that this can also be applied to other disciplines.

### **Literature Review**

#### **Cultural History of Dreams**

The foundation of this project is the interpretation and importance of dreams. Therefore, it is important start with a brief history of dreams and its place in the cultures during these times. It can be inferred that people have been dreaming since the dawning of man. The first evidence of this came from tablets dating back to 4000 B.C. The first evidence of a reference to dream

## SYMBOLIC INTERPRETATION STUDY

interpretation was the ancient Egyptians about 1350 B.C. They believed that dreams were messages from the gods. They believed that the gods would give villagers advance warnings of disasters or good fortune by giving them messages in their dreams. Ancient Egyptians are also known to be the initiators of a process called “dream incubation” where the person would sleep in a temple and, upon waking the next morning, would consult a priest called a Master of Secret Things, who would interpret the previous night’s dream (Schulze, 2007).

In Greece, many centuries later, there is evidence that dream analysis was practiced. In Homer’s *The Illiad*, there is a scene where Agamemnon received instructions from Zeus in a dream. But the Greeks used dreams one step further because they used dreams to aid in physical healing. As with the “dream incubation” of the Egyptians, the Greeks would send an ailing person to a temple and perform rituals and continuation this routine until this person received the necessary dream that showed that the person was healed of his or her physical condition (Schulze, 2007).

Much like today’s dream theories, Greece had its share of skeptics. In the 5<sup>th</sup> century, the Greek philosopher Heraclitus stated that he suggested that dreams were a product of one’s own mind. Aristotle negated one belief of the day and promoted another. On one hand, Aristotle he began to study dreams in a rational way and concluded that dreams were mere reflections about the waking events of previous days of the dreamer (Schulze, 2007).

On the other hand, Aristotle helped to advance the notion that dreams could enhance physical health. He promoted the idea of medicine being more holistic by asking an ailing patient

## SYMBOLIC INTERPRETATION STUDY

about recent dreams to help to diagnose the patient's deeper source of the ailment (Schulze, 2007).

Given the importance of dreams in these previous cultures, they became more culturally important during Biblical times with emergence of Christianity. Christians viewed dreams as having a supernatural element. At this time, the notion that dreams were messages from one supreme God. As a result, many men of Christianity started to preach that this singular God could be revealed through dreams (Schulze, 2007).

Among these men were St. Augustine and St. Jerome. Both of these religious icons claimed that the directions of their lives were dramatically affected by their dreams. Similarly, Mohammed claimed that much of the text of the Koran were direct results of dreams, as well as interpretation of many of his disciples dreams (Schulze, 2007).

Many centuries later, Martin Luther had an opposite view of the value of dreams. He believed that dreams were the work of the devil. He believed that only the church could interpret God's word. Therefore, he believed that revelations made to individuals were inherently evil (Schulze, 2007).

### **Freud and Jung**

Sigmund Freud is generally credited with the modern emphasis on dream interpretation. Although earlier research was made previous to this, Freud's *The Interpretation of Dreams*, published in 1899, is the first evidence of this modern movement. Freud, as neurologist, first introduced the idea of the unconscious. He believed that the only conscious path to this unconsciousness was through a method called free association. He also believed that dreams,

## SYMBOLIC INTERPRETATION STUDY

which were part of the unconscious, were expressions of waking life's wish fulfillments (Cambry & Carter, 2004).

In 1906, Carl Jung was a young medical doctor practicing in Zurich, Switzerland. At this time, Jung was treating patients with physical problems with this method of free association. He was also conducting some experiments on this method. In an attempt to deepen this knowledge and understanding of free association and ideas about the unconscious, Jung contacted Freud and expressed a desire to meet with Freud and learn these theories from him. In 1907, the two men met at Freud's home in Vienna, Austria. Their first conversation reportedly lasted 13 consecutive hours (Cambry & Carter, 2004).

For the next 15 years, these two men developed theories of psychoanalysis, dream interpretation, and the unconscious. However, in 1924, Freud publically denounced many of Jung theories about dreaming and the unconscious. Among the differing issues of the two men, one of these ideas was the many purposes of dreams. As stated earlier, Freud believed they were a result of wish fulfillment and were only of the level of instincts. He also believed that these dreams were strictly a result of the dreamer's personal history. Jung disagreed. He believed that dreams were messages from the unconscious. He also believed that the content of dreams could be from a period of time previous to the dreamer's physical life. This led to Jung's theories of personal unconscious and the collective unconscious. This also led to many other theories of archetypes, symbolism, myths across cultures, and active imagination (Cambry & Carter, 2004).

Although, most of Freud's ideas about dreams were refined or completely changed by subsequent psychologists, his methods of psychoanalysis are widely accepted. Jung, on the other

## SYMBOLIC INTERPRETATION STUDY

hand, had very few dream theories rejected or revised because of the complex nature of his theories. Also, because of their nature, are not very easily verifiable. As a result, the use of dreams in psychology is not a widely accepted method of correction of psychological problems, particularly in sports psychology, in mainstream psychology. This seems to be the modern de-emphasis on the importance of dream analysis (Cambry & Carter, 2004).

It was during this period that Jung developed the idea of Active Imagination. He believed that there only two ways to access the deep personal unconscious; fantasies and dreams. One of the ways that it could be accessed was by taking these dreams and fantasies and expressing them in some of art form like dialoguing, sculpture, painting, etc (Jung, 1974).

### **Neuroscientific Model**

The next hurdle for the importance of dream analysis is the emergence of neuroscientific approaches to dream content. This approach used scientific tools to map out where brain activity was most prevalent during dreaming. Aided by the use of MRIs, CAT scans, and PET scans, these mapped out what parts of the brain were active during dreams. One of the conclusions they made was that a large part of dreams happened during REM sleep. (Some later research has negated some of these conclusions.) Later in the research, these scientists began to use dream journals and a method of waking subjects up after REM sleep to ask about the content of the subject's dreams (Domhoff, 2003).

One of the conclusions made from these studies is in contradiction to many of Jung's theories on dreaming, not to mention the cultural history on dream interpretation. The conclusion was that dreaming was not important to mental and physical well-being. When this literature

## SYMBOLIC INTERPRETATION STUDY

tried to refute Jungian theories, it relies on the stances that Jungian theories are “dense” in theory and “unverifiable” in experimentation. Among these unverifiable ideas, neuroscientific theorists try to reject the idea of repression as a reason for certain Jungian aspects appearing in dreams (Domhoff, 2003). This seems rather ironic that these theorists would reject an idea like repression by repressing the idea that it exists. Despite its weak argument, this belief in the unimportance of dreams creates many blind spots in the perception of dream analysis, particularly from a Jungian perspective.

### **Lucid Dreaming**

Another roadblock to the acceptance of dreams in sports performance is the wide use of lucid dreaming in improving sports performance. This type of dream approach muddies the water of the perception of dreams in sports performance. This is not to say that lucid dreaming is not effective in improving performance because it can be effective. Lucid dreaming is an approach to dreaming that has the dreamer manipulate the mind to the point that the dreamer controls the dream, rather than letting the unconscious speak to the dreamer. One does not need to be sleeping to use this method. In waking life, this is called imagery. Athletes of all skill levels use it. It is very effective in improving athletic performance because it allows the mind to continually practice an athletic skill, without even opening one’s eyes (Vealey & Greenleaf).

This muddies the water because, to the casual observer, it seems as if the dreamer is using dream analysis to improve athletic performance. However, Jungian dream analysis affects the

## SYMBOLIC INTERPRETATION STUDY

dreamer/athlete at a much deeper level. Lucid dreaming helps the athlete with an immediate skill, which helps the performance in the short term. Dream analysis, on the other hand, makes changes at a much deeper level. It changes the source of the problem by recognizing and facing the deeper issues that lead to poorer performance.

### **Dream Work and Academic Performance**

Despite these setbacks to the image of Jungian dream analysis, there are still some parties that believe in its uses. One of these parties is Marina Quattrocchi. In 1995, she wrote a dissertation on using dream work with high school students to improve their inner lives and, in turn, improve academic performance. Quattrocchi, an experienced elementary and secondary teacher, used her passion for teaching and her experience with a dream journal to look for way to improve academic success for high school students. In the end, she concluded that dream work could be a positive influence on students' creativity and their place in their individuation.

Although her works seems effective on high school students, most of her applications worked on creative writing, visual art, and literary criticism. There was little evidence that it could improve physical skills through dream work.

## SYMBOLIC INTERPRETATION STUDY

Quattrocchi was not the only one that saw this connection between dream work and academic performance. Philip King, Bernard Welt, and Kelly Bulkeley also saw a strong connection between education and dream work when they co-authored their book, *Dreaming in the Classroom: Practices, Methods, and Resources in Dream Education (SUNY Series in Dream Studies, 2011)*. In this book, the authors expand some of the ideas brought forth by Quattrocchi. In the book, they demonstrate how dream work can be used in a wide array of subjects in high school, college, and graduate school. They also point out ways to use dream work to design syllabi and develop curriculums that embrace the ideas of dream work and dream analysis.

### **Dream Work and Physical Performance**

Despite great efforts, no evidence was found that anyone has attempted to connect dream work or dream analysis with sports performance or any other sports performance. There are three possible reasons for this lack of evidence. First, it is possible that a lack of research skills prevented this researcher from the necessary evidence of such previous works. Secondly, there could have been others that has proposed this type of study and found no connection between dreams and physical performance. Thirdly, no other parties have thought that such a study is important enough to consider.

### **Algebra as Symbolism**

A place to start to combine mathematics and symbolism is through Algebra. Like many disciplines of mathematics, Algebra has its own language. It is also the doorway to transforming

## SYMBOLIC INTERPRETATION STUDY

the art of numbers into an art of making general statements about the behavior of certain numbers and their operations. Algebra is all about detecting patterns and using the language of Algebra to make a conjecture about it. Replacing some numbers with letters in a mathematical statement is the way that this process is done. From doing this, we detect patterns in the behaviors of the operation that is being studied. Generalizations can be made and tested. If they pass the test, a rule can be made about these patterns. Since a symbol (the letter) is being used to reveal the pattern, we are basically learning symbolism and abstract thinking.

### **Pursuit of the Inner Self**

If the goal in the physical world is to become an abstract thinker through symbolism, the pursuit of the inner Self cannot be far behind. The Self is the core contents of the personal unconscious, as opposed to the self as part of one's persona. It is also the part of our minds that dictates our life's purpose, which is termed as individuation. According to Carl Jung (1964), there are only two ways to reveal the contents of the unconscious; fantasy and dreams. In either case, the messages are sent to the conscious mind through symbolism (Kaufmann, 2009, Whitmont, 1969, Mayes, 2007). In this way, students can pursue their life's paths much earlier than most other people. Therefore, they get a clearer vision of the path they are to follow for their lives at a much earlier time.

### **Method**

## SYMBOLIC INTERPRETATION STUDY

This project intends on being a case study of 3 high school mathematics classes (over a period of six weeks) where the teacher has agreed to use the idea of using a symbolic opening in their classes. As a starter, the first three weeks of items for interpretation will be provided. The researcher will also meet with the participating teachers to compile a single list, in case the teachers feel the provided list is inappropriate or ineffective. Also, some flexibility will be allowed in case a student wants to supply something to be interpreted. At the end of every two weeks during the semester, the teachers will answer questionnaires about the progress and impressions of the practice. At the end of the semester, pretests and posttests, which are required by the school district, could be compared to assess any academic growth in learning during the period. However, these will not be used in this study. Instead, teacher observations presented in the biweekly questionnaires will be used to detect any personal or academic growth. Increased or decreased interaction in class will also be observed.

Assessment will be based on final semester comparison statistics and questionnaires of open-ended questions to teachers. Stories from teachers, students, and parents will be encouraged but not required.

Data analysis will be based on participant perceptions, teacher perceptions, and the change in grades.

The study will be implemented in the following five stages;

- **Recruiting-** Three teachers will be recruited from the mathematics department in the high school where I teach. I have received an informal verbal commitment from the mathematics department head to cooperate. I will attempt to

## SYMBOLIC INTERPRETATION STUDY

recruit them verbally in conversation before the beginning of the study. If this proves unsuccessful, I will attempt to recruit fellow math teachers through email or at a departmental meeting.

- **Pre-Study meeting-** once the participating teachers have been established, and written permission from Saybrook University and the governing school district, I will meet with the three participating teachers. At this meeting, I will explain the study in detail to them. I will also present the first 15 symbolic sources (covering 3 weeks) to be used as warm ups. They will follow the following schedule; Monday will be a brief dream. Tuesday will be a poem. Wednesday will be a song lyric. Thursday will be a quote. Friday will be a dream, poem, song lyric, or quote. After two weeks, we will meet again to discuss ideas for the last three weeks, including possible input of examples from volunteering students.

- **Implementation-** Each teacher will follow the proceeding steps in implementing the study; 1) Display the item to be interpreted on a projection screen. 2) Teacher explains that students will have 10 minutes to write an interpretation of the item. The response should be three full lines (at least 30 words). Filling these requirements is worth 10 out of 10 points, with extra points for saying something “really profound” (teacher’s discretion.) At the end of the 10 minutes, the teacher will ask if any students want to share their response, for immediate credit. After all responses are exhausted, the teacher will comment on

## SYMBOLIC INTERPRETATION STUDY

the item. Then the teacher will transition into the planned lesson. All written responses are due on Friday of the week.

- **Questionnaires-** Participating teachers will be given questionnaires four different times; the beginning of the study, after two weeks, after 4 weeks, and at the end of the study. (See Appendix A.) These will be used in a qualitative manner to measure the perceptions of the quality of this intervention.
- **Evaluation-** In addition to the questionnaires, assessment of the project will be determined from three categories; 1) Academic improvement- grade average of the entire class will be compared statistically between before the intervention and after the completion of the intervention. 2) Personal growth- a comparison of behavior referrals, negative phone calls home by the teacher, and other behavior interventions (detention, changing seating assignment, etc.) of before and after the intervention. 3) Motivation- the number of verbal responses (at beginning and end), the length of the written responses (beginning and end), and number of “really profound” responses (beginning and end).

### Results

The design of the results of this study is in three parts; questionnaires, procedures to minimize off-task behaviors (referrals and phone calls to parents/guardians) and changes in grade averages. The philosophy behind this mixed method design is to have questionnaires to participating teachers as the heart of the study. The purpose of the other two phases (contacts and

## SYMBOLIC INTERPRETATION STUDY

grades) is meant to support the findings of the questionnaires to minimize any bias that may exist, whether this bias is conscious or unconscious.

**Questionnaires** As stated earlier, each participating teacher was asked to answer a standard questionnaire at four points during the study; the beginning, after two weeks, after four weeks and after the study is concluded. Each group of questionnaires had different purposes. The initial questionnaire was meant to establish the participants' expectations entering the study.

The middle questionnaires served two purposes. The first purpose of the questionnaires was to establish a pattern of the respondents. That is, does the respondent have a tendency to start optimistic and end pessimistic or do they tend to do the reverse? In this particular survey, all three respondents were rather consistent in their responses.

The second purpose was to keep a dialogue open between the researcher and the participants. In this way, the researcher was available to answer any questions about how to apply the intervention effectively. Also, it gave the respondents the opportunity to give suggestions on how to improve the intervention. This design proved to be quite effective throughout the study. Although many of the answers were included in the proposal, it was an opportunity to learn that those points needed to be made clearer to the participants. In addition, the participants gave some excellent suggestions, which I tried out in my own classroom as a laboratory.

As for the final questionnaire, this document was seen as the final opinions and observations of the people of the participants. In these responses, the participants tell the

## SYMBOLIC INTERPRETATION STUDY

researcher what they think of and observed about the implementation of the study. Therefore, this is where the researcher can see the conclusions of the people involved in the study.

Once these questionnaires were collected, all statements were categorized as supportive, critical or suggestive. All totaled, there were 31 suggestions (3 pages) made over the life of the study, 9 negative statements (2 Pages) on the last questionnaires, and 22 positive statements (four pages) on the final questionnaires.

The suggestions were very helpful. Of the 31 comments for improvement, 10 of them were about using audio and/or video warm ups. All suggestions supported the use of videos and/or as warm ups. After the first suggestion, I verbally supported a video approach. I also tried this idea and it was quite effective.

Among the other suggestions, many of them were about planning them to relate to the mathematics a little closer and collaborating with others. Other comments were mainly questions about grading and how to implement the warm ups into grading. However, there was one suggestion that was unique and worth mentioning (and trying at a later date);

I think the students should complete a questionnaire on how they liked/disliked completing these type opening assignments. The questionnaire should include the question of which type of Opening assignment they would prefer: Math Problems or Reading Passage to reflect upon. The questionnaire should also include a space for the students to include about things they'd like to see changed or included in their opening activity.

In the final surveys, there were nine negative comments. However, most of these comments were about students' lack of effort toward the assignment or excuses not to do the assignment ("I don't understand" or "what does this have to do with math.") One comment termed some of these students as "lazy." The majority of the rest of the comments were of the nature of trying to fit more mathematics in

## SYMBOLIC INTERPRETATION STUDY

the class time allotted. There were many students, but still a minority, that preferred to receive a warm up of math problems.

The heaviest portion of comments was definitely the positive comments. In the last questionnaires alone, there were 22 comments, occupying four pages. For the most part, all the participants replied that they would continue the practice, although not on a daily basis. The comments are varied and encouraging. Almost all observed that this practice led to more participation by most of the students. Of the ones that did participate, the teachers observed more inquisitive questions. One observed that a student wanted to do more research on the author of a quote. Here are some of the highlights;

- I found the practice effective in activating the student's logical processes. I do use math questions afterward and they have been observed to transition well from symbolic interpretation to the mathematical warm up. As more students participate in the discussion I have more students that are unafraid to speak up. They have worked hand in hand in my class to improve the student's attention span and participation in work.
- Many of students have begun to take a personal interest in their learning, they look and search for more information or more interpretations to have and share with the class. My students speak up about issues that occur in their lives and talk about how things need to change to achieve a better tomorrow. Students are more open to individual expression and are unafraid to answer questions.
- I believe they have a better mastery of the topics that were covered compared to how they have performed in the past.
- The students have become more inquisitive in general. I have had students become more interested in acquiring a more solid understanding of the world around them, students ask me more questions about both math and non-math related subjects. Some students have become or at least show outwardly of their thirst for knowledge.
- I feel it does improve performance. Many of the students grades have improved on an average of about 5-7 percentage points in comparison to their grades at the beginning of this study. The students have become more consistent in completing their homework and

## SYMBOLIC INTERPRETATION STUDY

classwork which are driving factor in their improvement. Even on days we get off track my students are more focused during class. I observe a decent amount of personal growth in myself because I take time to think about the profession and my approaches to it, I feel inspired to find more and interesting ways to present and relate content but I feel my students are becoming advocates for themselves. I can feel myself trying to find more ways to connect with the students because they are more accepting of learning more from me. I have decided to start a math club at the school, in part because of the interactions I have had with students and after seeing their thirst for new knowledge,

- More students are wanting to speak up in my class and have an opinion which is great for efficacy and for advocacy. I have noticed more student involvement in comparison to the 4 weeks mark when it comes to doing and turning in work. It seems like most students with exception of the students that do not do work in the first place, my students end up doing 90% of their work, overall.
- I have an okay relationship with my students so far, but I feel that I am becoming closer to them and they have more respect and care for me. The students seem more willing to do work and more ready to volunteer to help in the class or help me out. I believe a good portion of this is because of the study because I had never known as much about my students before and they were less likely to share or participate in the past.
- When students really expand on their feelings about the opening and write more than the required amount to write. Also, when the students relate the passage to their real-life experiences. Also, when students came in the classroom and didn't see a passage on the board for them to reflect on and they ask for it.
- I have noticed that some students that would always linger to complete their openings are completing the assignments but they are not as eager to read and share theirs with the class. I think some of them liked the change instead of jumping straight into math problems at the beginning of class.

## SYMBOLIC INTERPRETATION STUDY

**Referrals and negative phone calls** At the end of the study, each teacher was asked to produce the number of behavior referrals before and during the study. I followed this request (verbally and via several emails) with an email request to one of our assistant principals. All of this effort resulted in one teacher responding with

I made parent contact with 4 parents about 4 students since I began the study. 2 of the students I contact their parents multiple times, about 2 times for 1 and 3 times for another.

The assistant principal responded by saying that he would give me the information when he “gets the opportunity.” From this limited information, I can conclude very little.

**Grade average** I also asked, verbally and through several emails, for the posted grades of the students for the grading period before the study and near the end of the study. Once again, only one teacher responded. It was the same teacher who gave me the parent contact information. I was a little disappointed that the teacher that said “grades went up 3 to 7 points” never sent me the actual grades.

In analyzing the limited grades that I received, I realized that the results were likely to be skewed by many factors, like the interaction between one teacher and her students. With that being said, I looked at the scores of the three classes that she taught. For her classes, the grade average of her students before the study were 79.61, 76.43 and 51.11, respectively. After the study the scores were 75.07, 72.64 and 50.39. In all three classes, grades dropped from one grading period to the next. The approximate change was about 3 percentage points. With these few numbers, combined with the skewed of just one teacher, I concluded that this change was not very significant. In addition, two of three teachers stated in the questionnaires that they

## SYMBOLIC INTERPRETATION STUDY

observed very little changes in grades after the intervention. As stated earlier, the third participant claimed a “3 to 7 point increase in grades.” Therefore, this conclusion is consistent with the observations of most of the participants.

An additional bonus to the grades obtained was that this particular school system gives 4 and ½ week grades for behavior. In this system, each student receives a grade of Satisfactory, Needs Improvement or Unsatisfactory. In the grading period before the study, 43 were deemed Satisfactory, 23 were deemed Needs Improvement and none were deemed Unsatisfactory. In the grading period after the study, 49 were deemed Satisfactory, 13 were deemed Needs Improvement and 5 were deemed Unsatisfactory. In effect, of the 23 that needed improvement, 6 improved their behavior and 5 got worse. Therefore, it can be concluded that the intervention led to little change in behavior overall in the classroom.

### **Discussion**

**Expected outcome** When this study began, the expected outcome I had was based on personal experience as a high school mathematics teacher and was supported by research made in to the subject. This practice was tried in my own classroom (and no other that I am aware of) since August 2014. In that time, I have noticed several changes in the atmosphere of the classroom.

The idea behind this approach that the first fifteen minutes of a high school class is meant to be a time where the students “warm up” their brains for the tasks at hand. This is normally done in a high school mathematics class by giving three problems from the previous day’s lesson to solve. While this does “jog their memory” mathematically, it also reminds most students that

## SYMBOLIC INTERPRETATION STUDY

they are in a class that they dread. The use of symbolic interpretation warms up the mathematical brain (mathematics is essentially detecting patterns) and, at the same time, allows the student to do something more natural and enjoyable.

In my experience with this method, it has been a catalyst in building a closer relationship between the teacher and my students. When this is accomplished, teachers and students feel safer because they feel that everyone else in the room is supporting them, not fighting against them. When people feel supported, they perform better. From this, it is believed lesson plans are improved, classroom participation is improved, student performance is improved, and, therefore, performance on standardized tests also is improved. It is believed that this intervention is a win-win situation for everyone involved.

With this being said, it is important to realize that very little of these expectations can really be quantified in such a short study. Therefore, the design of this study relies heavily on the opinions and observations of the participating teachers. To support these opinions and observations, a few quantitative tools were used to support the teachers' findings. Unfortunately, very few of these measures were followed up.

**Actual outcome** From the questionnaires, it appears that the participants of the study had similar experiences to my own. All three participating teachers had observations of a closer relationship with their students than they had previously to the study. In the experience of one of the teachers, he felt a closer relationship with the students, he perceived that their grades went up, and he observed a higher amount of participation. In some cases, he saw students who were not participating at all turn into participants for the first time. In other students, he observed

## SYMBOLIC INTERPRETATION STUDY

certain students wanting to go deeper in their knowledge about the authors of quotes. The other two teachers saw similar experiences but their response were more brief and less demonstrative. (This excludes the theme of grades improvement. The other two teachers saw little improvement in grades.)

When asked the question, “Would you continue this practice after the completion of the study?”, all three responded with “yes” but with some modification. The most prominent and repeated modification was to map out the prompts over the duration of the course they are teaching. Others suggested that symbolic interpretation be used occasionally rather than regularly.

The only negatives I could detect from the questionnaires was a repeated question by students; “What has this got to do with math?” Assuming that this question is asked authentically and is not just oppositional, to me shows the resistance to look at things from a deeper perspective. If this question is repeated with sincerity, it would be wise to have a classroom discussion about what the teacher and the students believe that the definition of mathematics is. As stated previously, I see mathematics as the detection of patterns in anything.

**Error analysis** With this study, there were obvious sources of error or skewed data but there were also some sources that were not so obvious. The sources of error are the following;

- Secondary educators at this high school (and perhaps at most high schools) are very busy because of all the roles they are asked to fill. At the beginning of the study, one participating teacher asked, “Instead of meeting for this, can we just stay in contact by email?” I agreed but it was a mistake. By doing this, many

## SYMBOLIC INTERPRETATION STUDY

issues were not discussed and, therefore, important questions were not answered.

In addition, a lack of face-to-face meetings possibly led to documentation not being given to the researcher in a timely manner, if it was turned in at all.

- Some of the supporting documents could have been obtained from administrators instead of relying on teachers. Therefore, a request for grades and the number of referrals should have been obtained through such a request.
- The timing of this study prevented obtaining referrals, grades and parental contacts from administration at a less busy time like during the summer break. Most of this information is required to be turned in at the end of the school year. The rest of the information can be accessed through an electronic bookkeeping program administered by the school system.
- The program was completely volunteer-based with no incentives. Near the end, I passed out a \$10 gift card to participants as a personal thank you for participating. In retrospect, that was a small payment as compared to the amount of information I was asking for.
- It was suggested from one of the participants that a survey should be sent to the students of the classes, asking their opinion and preference about the different kind of opening. Such a questionnaire might shed some light on the teacher-observed behaviors of the students that were stated in the questionnaires.
- It is possible that there may have been some bias on the part of the teachers involved, including myself. Although all were volunteers, all three volunteers had

## SYMBOLIC INTERPRETATION STUDY

a working relationship with the researcher that has lasted over a couple of years.

This familiarity may have led to bias towards “helping” the researcher obtain course credit. The researcher tried to do everything to remove any bias but some inherent bias as result of the close relationship cannot be removed.

- The tardiness of the information could have biased the results because many of the questions were about changing perceptions. In this light, tardiness skews this changing perception.

**Future studies and uses and next steps** As stated in the questionnaires, all three participants, as well as the researcher, plan on continue the use of symbolic opening for their mathematics classes. Therefore, it might be helpful, to revisit these teachers at a later period of time and ask questions about the long-term results of using such a practice.

A second approach could be to gather the missing information of this study from school administrators and apply them to the results of this study. The study could thereby be completed as planned, but outside the time constraints of this paper.

Another approach could be to repeat this study but apply the following changes to tighten up the results and test the conclusion reached in this study;

- Develop an incentive system for completing the different phases of the study. For example, a financial stipend for each questionnaire, for referral information, parental contact information and posted grades. This stipend could be prorated for tardiness.

## SYMBOLIC INTERPRETATION STUDY

- Allow for observations by the researcher in participating classrooms. This could give a better perspective than the questionnaires and could be a cross-reference to the responses in the questionnaires.
- Insist on meeting on regular intervals and include these meeting as part of the stipend plan.
- Choose a school not familiar to the researcher. In this way, some bias can be removed.
- Develop a clearer plan of when and what kind of prompts to be used on each day of the study. However, this plan should be flexible enough to allow for teacher and/or student creativity.
- Include other prompts other than the printed word. It was suggested to use short videos in the practice. The researcher has experimented with some public speaking videos (i.e. Ted Talks) and music videos. The list could also include visual art, depending on the depth of thinking of the students.
- Include suggested questionnaires for students' opinions and other inputs.

### **Conclusion**

In the United States today, the way things are done in public school systems is under fire. (Chappell, 2013). People from all over the world are moving to the United States for its high-quality college systems (Zakaria, 2015). However, they are very disappointed with the public school systems (Zakaria, 2015). Therefore, anything that increases the students' involvement in

## SYMBOLIC INTERPRETATION STUDY

their secondary education is an improvement over what American schools have been doing for many years. From the questionnaires of this study, it is apparent that a symbolic approach to warm up mathematics students' minds is a step in that positive direction. Although this study had its previously stated flaws, it gives educators a tool that can be used to blend the students' natural interest in things interestingly symbolic and the symbolism needed, but unwanted, to perform required mathematics. As an added bonus, this approach leads educators and students into a closer relationship that can only help students to become the people they were meant to be, not mention the teachers. This can also lead to more inspired teachers, citizens and lifetime learners.

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