From Page to Stage:

Teachers’ Perception on the Use of In-Role Simulative Drama when Exploring Mathematical Word Problems

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Abstract

Given the decline in student mathematics scores, new approaches to teaching math concepts need to be explored. Drama has been recognized as an effective tool for fostering situational learning in other subjects. This qualitative study examined teachers’ beliefs about the influence of drama on their students’ engagement and understanding of mathematical problems as well as their own attitudes on using drama in the math classroom. Participating teachers were first provided with a lesson plan incorporating drama in math. Through the lens of the situated learning theory, I interviewed three educators in a semi-structured interview. The four themes that emerged were teacher comfort and attitude, student strategies and understanding, benefits of using drama in math, and obstacles for using drama in math. These findings suggest these teachers do believe the use of drama as beneficial in a math classroom, but the proper resources need to be in place to make these lessons feasible. With adequate support, teachers are more likely to attempt innovative strategies to engage their students in mathematics.

Keywords: drama, mathematics, situational learning, cross-curricular
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Chapter 1: Introduction

1.1 Introduction to the Research Study

Math is considered to be a core subject for students both in elementary and secondary school. It provides the building blocks and skills for many important high paying professions in our current society. Math is required to work as an engineer, economist, business owner. Without the basic math skills acquired throughout elementary and secondary schools, students cannot hope to become members of these occupations. Beyond employment, the ability to use and understand math is also an essential part of functioning in the world today. People use math to keep track of their finances, to determine the area of their floors in order to buy tile, to calculate the tax on an item at the store, and in many other everyday situations.

Despite the importance of math in our world, research shows that the math ability of students in Ontario has been decreasing. The EQAO 2013-2014 standardized test results show the percentage of students at or above grade level in grades 6 has decreased from 61% to 54% over the last five years (Provincial Assessment 2014, 2014). This means that students are not acquiring the essential skills they need to continue success in math. This is problematic because failure to meet the provincial standards in elementary school predicts continued difficulty in secondary school. For the 2011-2012 cohort, 68% of students who did not meet the standards in grade 3 and 6 enrolled in the applied math course in high school. 17% more students in the applied course failed to meet the standard in 2012 than students in the academic course (Provincial Assessment 2014, 2014). These results suggest that students in the future will continue to struggle to grasp mathematic concepts.

A common difficulty students have faced over the years when it comes to math is solving word problems. In Hegarty, Mayer, & Green’s (1992) article they argue students are often
capable of solving a mathematical problem when written numerically, but unable to do so when written linguistically. This research is concerning because this means students struggle to see the application of math in their lives. Word problems require students to make connections between the abstract math lessons and real life mathematical problems. This lack of understanding may potentially provide insight to some of the difficulties students are having that are limiting their overall grasp of mathematical concepts. This suggests that a greater effort is needed in order to support students when attempting to apply their theoretical knowledge to real situations.

Drama is traditionally not considered an important subject within the educational system. It does not receive as much attention as subjects like math or literacy and is commonly thought of as an easy extra subject. Despite these assumptions, drama actually provides many benefits for students in their learning. The application of drama into education has been successful in helping students connect to subjects such as social studies and literacy at a deeper level. Anderson (2004) argues that problem solving in-role allows students to deeply examine their thought processes in a critical way once out of role. Additionally, using drama in education provides the opportunity to create “as if” worlds that can foster situational learning (pp. 282, 284). The ability to role-play allows the subject material come to life for students while helping them make critical text-to-self connections. Additionally drama can help students become actively engaged in their learning.
1.2 Purpose of the Study

The purpose of this inquiry was to explore teacher perception of integrating simulated role-playing techniques into math curriculum, specifically word problems. It was observed through the eyes of three junior teachers in regards to their own classrooms. As aforementioned, fluency in math is an integral aspect of functioning successfully in society. Due to the decrease in junior students’ mathematical understandings, it is evident that the way we are teaching math to our students needs to be reformed. In the past, education has been primarily focused on textbook teaching. For a typical math lesson, students would turn to the page indicated by their teacher and complete a set of questions practicing the algorithm. While repetition of skills is important, this traditional method of teaching does not require students to apply their skills and think critically. Modern pedagogical approaches to teaching encourage students to become problem solvers and think beyond the limits of the textbook. It strives to help students make connections to their own lives and make sense of their world. New perspectives and alternatives strategies need to continue to be studied in order to help students of the future succeed.

Drama in education is starting to be considered beneficial to students’ when learning core curriculum. Often integrated into subjects like literacy and social studies, this modern pedagogical approach helps learners examine multiple perspectives, make text-to-self connections, and make critical inquires. Despite the growing interest in the integration of drama in the classroom, little research has been done to examine the integration of math and drama. Typically seen as subjects that share no connection, math and drama are rarely discussed together. In lieu of this, it is my suggestion that using drama techniques in math lessons can actually promote deeper understanding of material and engagement in learning, specifically of word problems.
1.3 Research Questions

The primary research question for this study was *What perceived effects do Ontario teachers predict an in role drama lesson might have on their junior student’s engagement in their learning and understanding of mathematical word problems?* In order to help unpack this inquiry, the following sub-questions were also examined:

- How might students respond to the use of drama when discussing a math word problem?
- How might students’ strategies for solving the math problem differ from normal when in role?
- How comfortable is the teacher with using drama in their classroom and what are their preconceived perceptions of drama in the classroom?

1.4 Background of the Researcher

My educational experiences as a child have made me very interested in discovering ways to make learning engaging for students. When I was a student in elementary and high school, I struggled to find motivation and excitement in my studies. Lecture style teaching made learning seem like a chore and never fully challenged my thinking to explore and discover new ideas. Although I received good grades, I never felt connected to the material I was learning. School for me involved memorizing facts, then forgetting them immediately after taking a cumulating test. This type of education does not effectively prepare students for the future. This lack of engagement I experienced has inspired me to become a teacher and discover ways to make learning meaningful for students.

My interests in engaging teaching methods lead me to the Drama in Education program at The University of Windsor. There I studied how to integrate drama into what some consider core curricula subjects. As a child drama was something I was always drawn to. Participating in
community plays and musicals was the only time that I felt the freedom to express my ideas and truly think deeply and critically about characters, themes, emotions, different perspectives etc. The idea of using drama in teaching seemed like such an innovative and exciting way to make curriculum material come to life. During this degree I had many practical experiences teaching lessons in school classrooms incorporating drama methods and techniques. I worked with a range of grades from Junior Kindergarten to grade 10 teaching subjects such as language arts, media literacy, and social studies. I noticed in these placements that my students were very engaged in the material I was teaching them. They were always excited to participate in activities and developed skills in critical thinking. Additionally, the associate teachers I worked with found that drama increased their students’ engagement. Due to these observations, I have developed an interest in the role drama can play in student motivation, passion for learning, and growth in understanding of ideas and concepts.

My experience in math as a young child was primarily positive. I enjoyed the exciting and fun challenge of solving equations and calculating answers. However, along with many of my peers I despised answering word problems. I struggled to make sense of those questions, because it was difficult to understand the actual application of the theoretical concepts my teacher was teaching me. I was taught by copying notes from the board describing how to use a specific algorithm, and answering questions from a math textbook. It involved no critical thinking, no engagement, and no application to my real life. As I grew older and math became more challenging I began to dislike it. I didn’t feel engaged in the problems I was solving which left me little motivation to attempt to learn the foundational concepts. Eventually, I stopped taking math courses.
These experiences both with drama and math has led me to question if the integration of these subjects would prove to be beneficial for students who like me fail to see the real world applications in math. Unlike subjects like literacy and social studies, it is difficult to see natural connections between drama and math. Despite this preconception, I am intrigued to see if drama methods could have an impact on students’ engagement and understanding in math. Utilizing drama methods in math classrooms could potentially help students feel engaged in their learning and help them see real connections to their lives.

1.5 Overview

This research paper consists of five chapters. Chapter 1 includes the introduction and purpose of the study, the research questions, as well as how I came to be involved in this topic and study. Chapter 2 contains a review of the literature. This will look in depth at what prior research has been done in mathematics and drama in education. Chapter 3 provides the methodology and procedure used in this study including information about the sample participants and data collection instruments. Chapter 4 identifies the participants in the study and describes the data as it addresses the research question. Chapter 5 includes implications of this study, and recommendations for the future. References and a list of appendixes follow at the end.

1.6 Definition of Terms

Throughout this paper a variety of terms will be used in relation to this study. **Role-play/in-role**: acting out a particular part or acting as a person or character in different situations (Oxford Dictionary). Students can take on a variety of roles within a lesson. For example, if discussing the story of “The Little Red Riding Hood”, some students could embody the wolf, some the grandmother, and some Little Red.
Process Drama: a form of role-playing and a “teaching methodology in which the teacher and the students work together to create an imaginary dramatic world and work within that world to explore a particular problem, situation, theme, or series of related themes, not for a separate audience, but for the benefit of the participants themselves” (TESOL Drama Files, 2010).

Simulations: Putting one into situations that imitate life in order to practice problem-solving skills. Similar to role drama yet very product centered and very structured (Basic Skills Unit LTD, 1985).

Simulative drama: The integration of simulations and role-play techniques.

Situational learning: Learning that allows learners to actively engage in real world problems (Lave & Wegner, 1991)

Traditional teaching style: For the context of this paper a traditional teaching style refers to methods that are very teacher centred, involve primarily rote learning, and rely on textbooks.

Non-traditional teaching style: For the purpose of this study a non-traditional teaching style refers to methods that are student centred, use rich open ended problem solving, cross-curricular integration in particular with drama, and engage students in their learning.
Chapter 2: Review Of Literature, Theories, And Research

The primary focus of this chapter is to review the literature that has shaped this study. It is split up into four sections: drama in education, role-play, mathematics in education, and the integration of drama into mathematics. Each section will give an in depth look at the research in each of these fields in relation to this case study topic. I will be using the situated learning theory framework to guide my literature review.

2.1 Theoretical Framework: Situated Learning Theory

Jean Lave and Etienne Wenger (1991) developed a theory that people learn best through active participation in material. They called it situated learning theory and broke it down into three characteristics.

![Situated Learning Theory Diagram](image)

Figure 1. Situated Learning Theory (Lave & Wegner, 1991)

Legitimate peripheral participation refers to how learners engage in social activities. They situate learning in the idea that it is placed in sociocultural contexts. As they become more comfortable in these contexts, they can move from peripheral to full participation. Community of practice refers to how the communities we are a part of shape our perspectives. And knowledge presented
in authentic context refers to the idea that learning should engage with real problems (Lave & Wegner, 1991). Though all three of these characteristics provide the framework in which I will analyze my data, I will particularly be focused on knowledge presented in authentic contexts.

2.1 Drama in Education Across the Curriculum:

With the rise of drama in education research and its acceptance, many studies have looked into its application across all subjects. In Kirk Robert Dorion’s (2009) study he observed how drama could be used in science classrooms to promote student engagement and understanding. He found that the utilization of drama in science was beneficial for students. Dorion (2009) found that “as the study progressed, the potential for drama to enable discourse and dialogue within the science classroom emerged as a central characteristic across all activities” (p. 2263). The multi-modal nature of communication within drama appealed to the variety of learning in the classroom. This enabled students to converse about science concepts in a manner that was not previously achieved within the traditional science classroom.

The students in this study felt as though they were given autonomy over their learning. Rather than solely teacher centered and directed, students were able to take control over their educational experience. The use of drama in this science class enabled students to become active participants rather than passive recipients. In addition, these lessons gave the students a sense of comfort and enjoyment. Dorion (2009) noted that “given that these drama activities involve such complexly described analogies, it is interesting to find students’ statements of comfort, enjoyment, and self-perceived understanding in relation to these analogies” (p. 2266). Despite the difficulty and complexity of the science concepts and analogies, it was clear that students authentically enjoyed the lesson.
Brenda Rosler (2008) also looked at integrating drama into other subjects, specifically social studies. Rosler observed that “students described their lack of engagement in school…they complained that social studies was boring when they had to read too many long pages containing unfamiliar words” (p. 268). In order to combat student’s disgruntlement for social studies she used process of role-play to get students physically and mentally engaged in history lessons. This drama technique allowed students to physically and emotionally delve into character and use their imagination within the guidelines of historical frameworks laid down by the teacher in order to authentically experience the material. Rosler (2008) acknowledged, “my students did not sit passively and listen to me talk about the soldiers who fought in the Revolutionary War; they donned Patriot uniforms and became colonists” (p. 271). Utilizing drama proved to be beneficial for Rosler’s students as it helped them make deeper connections with the curriculum content they were expected to learn. The author found that

*Students who engaged in processes of drama learned to combine texts to understand and create new texts. As they became engaged in the material, students collaborated with each other and became leaders in class while honoring the cultures they studied in…their textbooks* (p. 265).

In their study Jenifer Jasinski Schneider and Sylvia Jackson (2000) looked at process drama in a second and third grade classroom with a focus on literacy and writing. This in role process allowed students to learn from their interactions with their teacher and peers, which, according to Vygotsky’s socio-cognitive theory, is essential for development and growth (O’Donnell, 2008, p. 52). The study’s ultimate findings were positive. Schneider and Jackson (2000) found that, “Process drama led the students into other places, spaces, and times…that required the students to write for both authentic and invented purposes” (p. 50). This type of
exploration allowed the students to engage and make connections beyond what a traditional writing activity would allow. As mentioned in the article, process drama also allowed the teacher to use a variety of approaches to her lessons such as group work, modeling, and individual conferences (p. 50). By including various types of methods of instruction students were more likely to understand and feel confident in their work.

2.2 Role-Play:

Although the use of drama in education can come in many forms, the drama used in this study will primarily include in-role experiences. Role-play requires students and often the classroom teachers to engage in a scene or scenario, acting as if they were someone else. For example, a student may take on the role of the Big Bad Wolf if the class was looking at the story of the three little pigs. Bolton and Heathcote (1999) argue that role-play can enhance the learning potential of the material by giving students the power to engage directly with the material. They claim that working in-role allows children to experience shared learning, and stimulates their interest in the material.

In-role experiences enable learners to take an active role in their education and develop essential critical thinking skills. In a recent study researchers had undergraduate nursing students take on roles and act out scenarios that they are likely to face in the profession. Rather than rote memorizing of content, the students were situated in their learning. Allowing students to apply the theoretical knowledge into practical situations enabled them to practice problem-solving skills (Ertmer, Strobel, Cheng, Chen, Kim, Olesova, & Tomory, 2010). According to Ertmer et al.’s findings (2010) the nursing students all had the opportunity and were successful in applying their knowledge learned on the standards of practice. Additionally this experience allowed students to reflect on their problem solving in order to determine how to improve for the future.
A common form of role-play used in lessons is process drama. Heathcote and Bolton (1999) describe that, “Process drama is a tool for learning, and, when used effectively, it offers a way to mediate and focus the multiple sign systems that inform literacy development” (p. xv). Cecily O’Neill (1995), another educator well known for her work with process dramas, notes that “The characters, situations, events and issues that are created and explored within the dramatic world reflect and illuminate the real world” (p. 152). As the name suggests, process drama involves a progression and development of characters and situations. It requires the teacher and student to become invested in the scenario taking place as well as time for the action to progress. The depth involved in the role of process drama is beneficial in areas like social studies and English where it is important to delve into characters, emotions, multiple perspectives, and so forth.

While working with math problems the need to delve deep into a character’s emotions and perspectives as a class may not be necessary, as mathematic problems require mostly analytical and problem-solving skills. For the purpose of this study, students will only need to enter their role as far as they need to in order to solve the mathematical word problem they are challenged with.

In the 1970’s many researchers explored a teaching technique they called simulation. Similar to process drama, simulation and gaming allowed students to learn through experience (Basic Skills Unit LTD, 1985). However in simulative learning students are faced with real world challenges they need to solve. It is more product-centered and structured (Basic Skills Unit LTD, 1985). In this teaching approach students are not required to necessarily delve deep into the emotions of their character, but simply act out a real life situation in order to promote engagement and understanding. This educational strategy could be considered situated learning.
“They treat thinking and learning as something that is constituted in the lived-in-world – the world as it is experienced in social practice…This means that concepts such as roles, identities, rules and social structures are realized in everyday activity” (Arnseth, 2008, p. 294). By bringing potential real life situations to life through drama, students will be able to make essential self to world connections.

Simulation and role-play share many commonalities and are thus often used in tandem. DeNeve and Heppner (1997) used role-play simulations with undergraduate psychology students to see how it affected their overall learning experience. They note that “the objectives of role play simulations are: (a) to arouse student interest for a particular field of study, (b) to help students apply material learned in class, (c) to help students develop insight into the group dynamics of problem solving situations…” (p.243). By combining the two methods students have the opportunity to be situated in their learning.

This use of simulation will thus be an essential component of this research study and will be used in combination with role-play. This fusion will be referred to as simulative drama for the duration of this paper.

Although the research shows that drama can be beneficial in the classroom, there are obstacles that inhibit teachers from using it. In Greenwood’s (2010) article she discusses the pressures educators feel in their classroom.

They experience a frequent mismatch between what they feel required, or able, to teach and the personal aspirations and employment hopes of many of their students. The real world and the curriculum of schooling are at odds with each other, and teachers are jammed between them, gradually pushed to the bottom by both. (Greenwood, 2010 p. 72)

This indicates that although teachers want to bring innovative strategies into their classroom, this pressure to perform and meet standards within a certain time constraint is a big deterrent.
2.3 Mathematics Education:

Mathematics is considered to be one of the most important subjects taught in school. The majority of high paying careers require immense skill, knowledge, and problem-solving capabilities within the mathematics field. Despite this importance of this subject, Canadian students’ math scores are decreasing both on a provincial and international level. Between 2003 and 2012 Canada scores on the Programme for International Assessment (PISA) test dropped almost five percent (OECD 2015). Due to this general decline it is important that we continue to develop more proficient and beneficial ways to teach students mathematics.

Thinking about general perspectives on effective math teaching can help inform better practice. Lucas and Fugitt (2009) conducted a qualitative study in a rural community in Illinois. They found that the adults in that town believed that practicing arithmetic was the key to becoming proficient at math. One participant said, “I once had an honor student who couldn’t do basic math, and I do mean basic math…she looked at me and asked, what’s thirty-seven minus twenty-five? Kids have absolutely no critical thinking skills. They have no idea how to problem-solve” (p.43). Here this person seemingly believed that basic computational skills were required to be a good problem-solver. However, according to Weintraub (2004) this is not the case. She notes that, “arithmetic is to mathematics as spelling is to writing”. In order to create effective critical thinkers in the math classroom, we must think beyond the limits of rote memory and skill.

When people recall their experiences with math throughout their education, it is often met with disdain. The traditional method of teaching mathematics, like most traditional ways of teaching is teacher centered and not very applicable to the real world. In a study that compared a traditional math textbook to a newer reform based textbook, it was evidently clear that traditional
book made little connection to real world mathematical problems (Sood & Jitendra, 2007, p. 145). This proves problematic, as students cannot apply their acquired math skills in real situations. Another study done by Jo Boaler (1996) in the United Kingdom demonstrated the downfalls of traditional math classrooms.

> Much of the students’ behaviour in lessons and many of their comments in interviews suggest that students are not only incapable of using their school methods, but the nature of their schooling may actually have diminished their capability to solve mathematics problems in real-world situations (p. 32).

If the purpose of education is to provide students with the skills and knowledge to be successful in the real world, traditional classrooms are failing to prepare them. By focusing solely on theoretical problems and using the “chalk and talk” and “drill and practice” (p. 32) methods of teaching, students will continue to struggle in math.

As aforementioned, the traditional methods of teaching do not help create situational learning in the classroom. Learning under this way of teaching makes it difficult for students to relate their knowledge gained to real life situations. Perhaps related to this disconnect from reality, students often struggle to solve word problems and when they do they do not have a full understanding of what the question was asking. Students in this case skip the word portion of the question and simply pluck out the numbers needed to plug into the algorithm. While repetition of skills is important, this traditional method of teaching does not require students to apply their skills and think critically. Modern pedagogical approaches to teaching encourage students to become problem solvers and think beyond the limits of the textbook. It strives to help students make connections to their own lives and make sense of their world. New perspectives and
alternative strategies need to continue to be studied in order to help students of the future succeed.

In the majority of research on mathematical word problems, suggestions are made to help students make sense of the question. In their article, William P. Dunlap and Martha McKnight (1980) suggest that students follow a step-by-step process in order to solve a problem. First students must decode the problem by breaking it apart, then they must look at the whole meaning of the question, then they must translate it into math language, then determine questions and so on (p. 432). A more recent study suggests using a similar step-by-step process, as well as tactics like teaching specific strategies like “work backwards” and “draw a picture”. They also suggest teaching students to separate the mathematical process from content (Forsten, 2011, p.23).

However, very little research has been done that encourages students to make real world connections with the text. As an educator this surprised me, as word problems are the only mathematical problems that contain real life situations, which as aforementioned is something students struggle to grapple with. This gap is what this study hopes to fill. Due to the decrease in junior students’ mathematical understandings, it is evident that the way we are teaching math to our students needs to be reformed.

Despite the problems with the way students are currently learning math, researchers are exploring how math education can be reformed. A prominent theory in mathematics education is constructivist theory. Constructivist theorists claim that students cannot learn by being told information, they must have opportunities to construct their own knowledge based off of meaningful learning experiences. This means that constructivism is an approach to teaching where students construct their knowledge and understanding based off of what they know.
(Hyslop-Margison & Strobel, 2008, p. 77). In this method of teaching it is much more student centered and encourages students to problem solve.

Marian Small (2010) is a prominent innovator in the field of mathematics. She proposes that math teachers can make math meaningful for students by changing the type of questions we give them. “Each technique [open-ended and parallel tasks] enables students to enter into a mathematical conversation from different access points — one by using a wide net and the other by being deliberately, but thoughtfully, focused” (p.29). According to Small (2010), open-ended tasks allow for students of varying levels engage in meaning math. There is no true one answer allowing students to move away from the fear of being wrong. Additionally, this approach offers opportunity for student choice and allows students to answer in a way that works best for them.

The three-part lesson plan has been developed to help support learners in math. In her book Cathy Marks Krpan (2013) describes the three-part lesson plan as a great way to teach students through problem solving as it “provides opportunities for student investigations and mathematical communication” (p.xiii). The three part lesson is consists of a minds on activity which prepares students to engage in the problem, working on it where students actively work to solve the problem in groups, and finally consolidation in which students has the opportunity to share their solutions and learn from their peers (Marks Krpan, 2013). This approach of teaching math is favourable in the Ontario. In 2011 the Ministry of Education put out a document in which teachers could go to for support when constructing three-part math lessons. The lesson devised for this study (see Appendix C) was created using an open-ended question within the structure of a three-part math lesson because they are prominent theories in the mathematics education realm.
2.4 Integration of Drama into Mathematics:

Despite the inclination to separate drama and math, there have been some studies to encourage its integration. In George Hardy’s (2008) study, he found that his students responded well to the integration of drama and props into the math classroom. “Students have found these lessons stimulating and memorable; this latter quality is especially important when revisiting topics for the purpose of revision” (p.211). This cross-curricular exploration appealed to all different types of learners and helped students both engage and understand the content material. In another study, researchers looked at incorporating drama into math with early years learners. “The whole project confirmed our belief that good role play can develop children's experiences in all six areas of learning” (Tyce, 2002). The areas of learning referred to include mathematics, language, and physical development.

The research done on the incorporation of drama into math education is fairly limited and under developed. For example, in the first study mentioned, the breadth of actual drama was narrow. Drama in this case was used in order to visually represent parts of equations (Hardy, 2008, p. 211). Although this use of drama seemed to engage students further into their math, it was not a very good use of drama and wasn’t looking at authentic and challenging math problems. In order to fully explore the possibilities within drama in mathematics education, the quality of both drama and math must not be sacrificed. With this in mind, the goal of this particular study is to look at the integration and its benefits without losing the quality and challenge of math and drama.

The next section of this paper will look into the methodologies that will be used to carry out this research endeavour.
Chapter 3: Methodologies

3.0 Introduction

As identified in chapters one and two, students in Ontario are struggling in mathematics. Standardized test results show that students’ math ability has been consistently decreasing. This research study From Page to Stage: The Use of In-Role Drama Activities when Exploring Mathematical Word Problems was conducted through interviews of three junior schoolteachers. The data collected provides insight into perceived effects Ontario teachers predict an in role drama lesson might have on their junior student’s engagement in their learning and understanding of mathematical word problems. The interviews were recorded with a digital recording device, transcribed, and coded according to patterns and themes that arose in relation to the study as well as previous literature reviewed in chapter two.

3.1 Research Approach and Procedures

Prior to conducting this research study as well throughout the process, I reviewed previous relevant literature to help guide and provide clarity and understanding. These studies serve as the backbone to this study.

Through this small scale qualitative study using some elements of the case study approach, I observed the perceived effects Ontario teachers predict an in role drama lesson might have had on their junior student’s engagement in their learning and understanding of mathematical word problem. Additionally, I looked at teachers’ overall perspective of the utilization of drama techniques within the classroom.

We study through a qualitative lens when we want to explore a problem. Qualitative design lends itself to studies that are interested in a complex understanding of a problem (Creswell, 2013). This study is qualitative as it aims to understand the perspectives of everyday
teachers on problem that is a huge challenge to education and on a potential solution. It is important to understand teacher perspectives because it is teachers who ultimately must facilitate the theoretical ideas of researchers in their classroom. The elements of the case study methodology that were employed within this study are the exploration of an issue, namely the current struggle with mathematics, across three cases; the description of the cases along with the identification of themes thoroughly explored within the findings section; and the conclusions drawn by identifying patterns and general lessons from studying the cases (Creswell, 2013).

3.2 Instruments of Data Collection

I collected data through the use of semi-structured interviews (see Appendix B). Prior to the interview each teacher received the same detailed lesson plan (see Appendix C) that integrates drama and math, which they will be asked to read. The lesson, targeted at a grade six class, will illustrate how a teacher might teach mathematical word problems using role-play. Within a week after the teachers received the lesson, they were interviewed using a set of nineteen questions aimed at discovering their perception of their students’ engagement in math and ability to solve mathematical word problems, their pre-existing opinions about utilizing drama within the mathematics classroom, and finally their thoughts and reactions to the example lesson given.

The interviews were conducted according the teacher’s availability and were up to an hour long. They took place at an ofsite location chosen by the interviewee, or if necessary a quiet and private location at the school. The interviews were semi-structured and all participants were asked the same set of questions. If during an interview I felt a follow-up question was necessary to better understand or clarify what the interviewee was saying, I asked said additional question. Any follow-up questions that arose were on a situational basis and were thusly not
asked of all participants. All interviews were recorded using a digital recording device and were transcribed shortly after completion.

3.3 Participants

3.3.1 Sampling Criteria

In order to observe general teacher perception and opinion of utilizing drama and role-play techniques within the subject of math, it was important to have teacher participants that were not experts in the field of drama. They may have had some experience using it, but it was not something they had studied immensely. This lowered bias towards a positive opinion of drama as well as helped me, as an educator and researcher understand the perspectives of average junior schoolteachers in regards to this method of teaching. Additionally, due to the fact I was interested in exploring perceptions of mathematic teachers it was essential I found participants who had taught math. According to Creswell (2013), it is important to include participants who have experienced with the problem being studied. For this reason I interviewed three teachers teaching math to their junior school students. They were selected based on the following criteria:

1) They had taught math within the junior division within the last year.
2) They were willing to be involved in a research project and share their opinions and ideas.
3) They had no significant prior experience with drama.

3.3.2 Sampling Procedures

I recruited participants primarily through word of mouth and emailing--asking colleagues and former practicum AT’s for recommendations based on my criteria. My first participant was a former associate teacher from the previous year who I contacted over email, my second participant was recommended to me by one of my peers at Ontario Institute for Studies in
Education (OISE), and my third participant was referred to me by the principal of a personal contact.

3.3.3 Participant Biographies

In order to protect the anonymity of the participants in this study, pseudonyms have been used in place of all names and identifiers.

Edith is a Toronto educator working in the Toronto District School Board. She has been teaching for 24 years. She started out as a high school computer science and math teacher in a private school, then moved to her current location shortly after. She began there by teaching French and Physical Education then eventually moved on to become a core teacher in the junior grades. She said she felt most comfortable teaching once she had a whole class and prefers teaching grade 6.

Sybil has been working as an educator in the Toronto District School Board for about 14 years. She has taught various grades between kindergarten and grade 8 as well as all subjects. Within the last two years she has been working in special education and gifted classrooms. She is currently on a leave of absence, but most recently taught grade 6 gifted students. Sybil feels most comfortable teaching language and math.

Mary is a teacher working at a private school in Toronto. She has been teaching there for seven years and has mainly taught math and science to grades 3 to 7 and biology to grades 11 and 12. She has a Phd in biochemistry so she expressed that she felt most comfortable working with older students. Despite this she continued to say that as she gains experience with grades 5 to 7.
3.4 Data Analysis

Once transcribed, I coded the data by looking for any patterns, themes, or interesting phrases that were relevant to my research questions and connected to reviewed literature. For this process I initially went through the document and highlighted anything I thought was significant using one general colour. These “codable moments” enabled me to draw my focus to anything I initially found interesting or that aligned with my research question (Sadala, 2009). Once I did this, I began to preliminarily code the data using both descriptive and In Vivo codes. After this first wave I moved on and went through the passages again and began to rearrange, group, and extend codes. This process happened many times. Rarely is the first cycle of coding data perfectly attempted. “The second cycle (and possibly the third and fourth, and so on) of recoding further manages, filters, highlights, and focuses the salient features of the qualitative data record…” (Saldana, 2009). These major themes are explored extensively within chapters four (Findings) and five (Discussion).

3.5 Ethical Review Procedures

The participants of this study were given letters of consent, which they read and signed in order to be a part of this study. This letter (see Appendix A) contained detailed information on what the study was about, what their participation entailed, as well as how their confidentiality will continue to be ensured. The teachers participating received a copy of this agreement, and another copy was kept as part of the records for this study. All interviews were given at a negotiated time and place. Every effort was made to ensure that participants felt comfortable and willing to be a part of this study.

At the beginning of each interview, I briefly reviewed my research topic with my participants and ensured they were aware that they could refrain from commenting on any
question they didn’t feel comfortable answering, they at anytime could revise their answers, and that at anytime during the research process they could ask that their data be removed from the study. All procedures followed what is stated in the letter of consent form signed before any interviews were conducted. No changes were made throughout the research or writing process.

All information that may compromise the anonymity of a participant has been concealed using pseudonyms for names and institutions. Any individual-specific information was omitted or altered to ensure the protection of the participants in this study. There were also no known risks to participation in this study.

3.6 Methodological Limitations and Strengths

As with any research endeavour there will always be limits to what can be explored. Within this study there were some limitations that could be explored further in the future. Firstly, the sample size of this study was very small providing a narrow scope of the perception of drama within the math classroom. For the purpose of this study, my intention was to closely observe teachers in relation to drama and math in order to improve my own practices as an educator. Although this is provides specific and intimate data that offers insight into the detailed opinions of particular Ontario teachers, further research could be done to examine the perceptions of a wider spectrum of teachers in order to make this information more generalizable.

Secondly, solely interviewing teachers provides limitations. For this study I was interested in learning more about the teacher perspective of utilizing drama across the curriculum and specifically in math classrooms. However, for future research it may be beneficial to also interview students to uncover their opinions and perspective of participating in role-play and drama activities while learning math. Additionally, interviewing members of the administration
such as principals could provide a more well rounded insight to perceptions of drama within the math classroom.

Thirdly, this study is limited because the teachers were not able to actually see the effects of the drama and math lesson on their students. Due to time constraints it was impossible to have the participants actually facilitate the lesson in their classroom, so they had to base their answers off what they think would happen. Had they been able to implement it would have provided a more informed opinion on the use of simulative drama in the math classroom. This may be another area of interest that could be examined by a study taking place over a longer period of time in order to see how effectively the average teacher uses role play in their classroom.

Fourthly, due to the scope of the Master of Teaching project my literature review is selective. While researching I carefully selected varied resources that I felt were integral to my project. If this research were to be taken further in the future, I would ensure to continue to broaden the amount and range of literature reviewed.

3.7 Conclusion

In this chapter I have outlined how this study was carried out. I discussed the approaches and procedure as well as the collection of data. I detailed the criteria in which I had for my participants, how I selected my sample, and gave a description of each of my participants. I also reviewed the ethical procedures as well as the limitations to this study. In the following chapter I unpack the data collected through interview in connection to the previous literature.
Chapter 4: Findings

As aforementioned my primary research question was *What perceived effects do Ontario teachers predict an in role drama lesson might have on their junior student’s engagement in their learning and understanding of mathematical word problems.* I also wanted to see if they believed student strategies for solving word problems would differ from usual when in role. Moreover, I was interested in investigating the attitudes and preconceptions about drama these teachers had and what their comfort level with the subject was.

Keeping these questions in mind, I interviewed three junior level teachers working in the Toronto area. Two of the teachers, Sybil and Edith, have been working in the Toronto District School board. Sybil has been teaching for about 14 years and has most recently taught grade 6 gifted students. Edith has been teaching for 24 years and has been predominately teaching grades 4 to 6. My third participant, Mary is a teacher working at a private school. She has been teaching for seven years and has mainly taught math to grades 3 to 7.

Through these interviews many themes and sub-themes emerged. This chapter is organized by these themes as follows:

4.1 Teacher Comfort and Attitude

- 4.1.1 Teacher Practice
- 4.1.2 Comfort Level With Drama
- 4.1.3 Attitudes Toward Drama

4.2 Student Strategies and Understanding

- 4.2.1 Student Ability
- 4.2.2 Student Strategies Before and After Drama
- 4.2.3 Student Understanding

4.3 Benefits of Using Drama in Math

- 4.3.1 Student Engagement
- 4.3.2 Situational Learning
4.3.3 Aiding Communication and Promoting Collaboration

4.4 Obstacles for Drama/Math and Teacher Suggestions

- 4.4.1 Time Constraints
- 4.4.2 Lack of Resources and Space and Groupings
- 4.4.3 Need for Scaffolding and Good Rapport

4.1 Teacher Comfort and Attitude Toward Simulative Drama in the Math Classroom

4.1.1 Teacher Practice

For the purpose of this study, it was important and relevant to uncover the teaching practices of the participants. This helps to situate where these educators stand when it comes to using drama in the math classroom.

![Figure 1. Participant’s teaching style/attitudes](image)

As Figure 1 illustrates the teaching approaches and attitudes of the participants existed on a spectrum from traditional to non-traditional. As previously defined, in the context of this paper a traditional teaching style refers to the practice of rote memorization, a strong use of textbook learning, and teacher centered lessons, while a non-traditional approach refers to the use of rich open ended problem solving, student’s active participation in their learning, use of drama, and student-centered lessons.

Edith and Mary both had similar traditional practices when it came to teaching math word problems. They both described going through examples step by step, discussing any questions
the students had, giving time to work on the assigned homework, then taking up some of the homework the next day. They both mentioned bringing out manipulatives when appropriate to assist their students with their learning.

In particular, Mary felt that it was important to have her students practice many questions in order to achieve understanding:

> Usually my lessons have at least 15 problems per topic... you sit down and do your work...especially from math for the younger grades I push them toward independent work because at the end of the day you want each one of them to go home with understanding.  
> (Mary, 2015)

This perspective is in contrast of the current research. According to Boaler (2006) this traditional focus on drill and practice does not affectively prepare students to solve real world mathematical problems. By focusing solely on this approach students will continue to struggle in mathematics.

Conversely, Sybil’s teaching style adopted a more non-traditional approach. She appeared to be an educator that was committed to professional development. She recognized and utilized updated approaches to teaching such as the three-part math lesson. During her interview she described her practice as starting with a minds-on activity, giving the students challenges to work on in groups, then having them hand in something so she could ensure they understood the concepts. She also mentioned how she often gives her students Fermi problems, problems with no definitive answer, and why she believes that that kind of conceptual problem solving is beneficial:

> Like just bigger solving and they’re still doing multiplication whatever our unit might be but its just better than question one question two from the textbook. It doesn’t really tell me much. You can look at their comprehension by looking at one or two questions rather than 20. Most people are into that. A lot of older teachers are not.  
> (Sybil, 2015)
Sybil’s approach to teaching aligns with the current research in mathematics. According to Marian Small (2010), good questions allow for multiple points of entry and may not result in the same answer. She believes that open-ended questions, like the Fermi questions Sybil used in her classroom, allows teachers to meet the individual needs of all students while still engaging students in meaningful math. Sybil was also interested in constructivist approaches that focused less on “skill and drill” and more on engaging students actively in their problem solving and construct their knowledge through meaningful learning experiences (Hyslop-Margison & Strobel, 2008).

Though Edith took a very traditional approach to her math classroom, she expressed utilizing drama throughout the other subjects in the curriculum, which has placed her somewhere in the middle on the spectrum of traditional to non-traditional (Figure 1). Sybil also utilized drama in her class outside of mathematics. Both educators believed that it was a great tool when combined with language arts, social studies, and science.

Yeah we will use drama like when were doing social studies or linking it to social studies for example when we did um ancient civilizations so we took some plays and uh you know Greek plays lets say ancient Greece um they were fantastic uh the kids really enjoyed it so they love doing that. In language depending on what were doing like if were reading myths if we’re reading novels we try incorporate drama whenever we can. Tableau or making skits or writing in role, being in role. So yeah we do use it in social studies and language.
(Edith, 2015)

This is consistent with research in drama in education. Research by Schneider and Jackson (2000), Dorion (2009), and Rosler (2008) suggests that the utilization of drama in science, language arts, and social studies can be beneficial for students.

Mary on the other hand did not express that she ever utilized drama in her classroom or that she ever had the desire to. However, it is important to note that she was solely a math
educator and did not have the opportunity to teach subjects like English and social studies that lend themselves more to drama.

4.1.2 Comfort Level With Drama

The educators in this study all had differing experiences with drama. While talking to Sybil I discovered that was very comfortable using drama. Although she only had a little bit of experience with it, she took an additional qualification in drama in order to begin incorporating it into her language arts classroom. In the interview she exuded confidence when talking about drama and seemed to feel very comfortable with the idea of trying out the lesson in her classroom. She offered her own ideas as to how she might use it and thought it was very feasible.

Edith also didn’t have a lot of experience with drama. She told me that as a child she was quite shy and thus did not enjoy drama. It wasn’t until she took a drama course later in life that she begun to enjoy it. She found it actually helped her gain confidence in terms of utilizing teaching methods that were non-traditional.

I took a drama course because I was very shy when I was in school too and drama was not one of the things that really enjoyed. I would cringe every time we had to do something in drama. So actually, a couple--I don’t know ten years ago when I was living in California I just took, because I was off, I just took a drama course. And that really kind of helped me, and it kind of helped me in my class to being a little bit more (takes big breath) brave doing certain things and trying things out.

(Edith, 2015)

Despite this willingness to try new strategies, she still expressed that she still did not feel completely comfortable with drama.

Mary had no experience with drama both inside and outside the classroom. When prompted she disclosed that she wasn’t entirely sure what drama in the classroom would look like. “If I'm going to get somebody to be the sales person to sell cupcakes, I don't know this is drama? I don't know which category would use that in” (Mary, 2015).
She seemed very dismissive and unwilling to expand which gave me the impression that she did not feel that comfortable with the idea of using drama to teach math in her classroom. She did however say later that she would feel comfortable using drama for fun.

When asked about the actual drama lesson both Edith and Sybil expressed that they would feel comfortable attempting the lesson I created. They both agreed that the lesson seemed very manageable as long as the students were given proper scaffolding prior to. They also believed that other educators could implement this lesson as long as they were not afraid to let go of some of the control in the classroom.

**4.1.3 Attitudes Toward Drama.**

As I predicted, the comfort level for using drama was correlated with the teachers’ attitude toward the drama/math lesson. Of the three teachers I interviewed, two responded positively to the lesson. Edith was initially skeptical about the integration of math and drama, but found that the drama lesson showed her the possibilities and benefits. She thought the lesson was creative and was especially drawn to the cross curricular connections.

The whole idea right now in education is to integrate you know as much as you can so to make connections you know when we’re doing things... so definitely you know linking the different subjects for sure. Drama is one of the subjects and linking it to other areas I think it’s good. I mean I’ve seen it be successful in my language and my social studies. (Edith, 2015)

Sybil also thought the cross-curricular aspects of the lesson were very smart. She felt that this was a very interesting approach to using drama in the classroom.

Sure, I can predict that it would be a good addition to the science curriculum. Absolutely! There's a lot of elements. If you took that little snippet of a lesson and took it here and made it into something much larger, which it would be, you could use it as a whole big cross curricular between drama and math and science and some social studies. (Sybil, 2015)
She could really see the current potential of the lesson, as well as what one could do to make it even better. Sybil additionally was hopeful that young educators, like myself, were trying to uncover new angles to approach teaching.

In contrast, Mary did not believe that using drama in her mathematics class was worth the effort. She expressed that she could not see how drama would help her students solve the problem, and felt that it was a waste of time in her situation:

My reaction was it's not going to help. That is what I was thinking because I had something in mind from my student in my class. He is very good in math but his problem, well it is not a problem but his issue is he has no patience. He cannot sit down and do the work… Okay so maybe for him it'll be fun because he likes to move…then okay he will say ‘what's the problem’? How is this going to have him to write? He will do it in his mind. Right now he can do it in his mind, but then doing it with drama I cannot I cannot see it happening.

(Mary, 2015)

Mary’s attitude does not correspond well with the previous literature. In Dorian’s (2009) study he found that drama actually improved his students’ discussion on the material. The multi-mode nature of drama allowed for discourse that appealed to a variety of learners and learning styles. The act of discussion amongst his peers and the expectation to explain his problem solving as an expert during the consolidation would require this student to show his work.

From these interviews all of the educators acknowledged the teacher perception and misconception that drama is for play. Mary in particular had difficulty seeing how drama could be valuable in a classroom: “You'll be so excited and all in the role, and it is fine let's go play! But then sit down and go back to the routine, it is going to be hard for this specific school.”

(Mary, 2015). One can see how in Mary’s opinion there is a clear divide between drama and “work” and the two cannot be intertwined.

Additionally, Edith added that this perception is not exclusive to teachers. When students hear that they will be doing drama, they too automatically think that they will be having fun.
So for them it’s like “Aw yay”, you know? “We get to fool around now, we get to play”. Because, you know, people kind of have this vision of drama is when they have fun. Which it is, it is fun so for some kids it might be, “Oh I’m not going to do any work”.

Considering that there is a movement toward play-based learning in the field of education, it is interesting that all the teachers in this study found that the idea of drama being considered play negative. Vygotsky (1967) argues that play is key part of development in the early years and that it helps children develop strong abstract thinking. Though the grade range focused on in this study is not early learners, it still is significant that play is widely accepted as an important piece of development.

In my conversation with Sybil she mentioned that a lot of prior work must to be done to undo these misconceptions to ensure that students take drama seriously. Drama and work are not mutually exclusive concepts, and we much teach our children that learning and work can also be enjoyable. In addition, she specifically talked about this stigma and how it can affect whether or not a teacher will use drama in their classroom. If a teacher believes that their students will only be playing when participating in drama they will not find it beneficial or worth the effort.

4.2 Student Strategies and Understanding

4.2.1 Teacher’s Perception of Student Ability

The educators in this research study unanimously thought that their students were best at number computation and number sense in comparison to the other four strands of math in the Ontario curriculum. This is synonymous with the PISA 2012 scores for Canada. According to PISA, 86.2% of Canadian students successfully could complete level 2 questions, which require students to employ basic uses of algorithms (OECD, 2015).

Both Sybil and Mary perceived that their students’ weakness in mathematics was solving word problems. This echoes what the PISA scores have revealed about Canadian students math
ability. According to scores from 2012, only 16.4% of students were able to competently answer level 5 questions, which require problem solving strategies (CMEC, 2015). Sybil found that her regular students had difficulty showing a full understanding of how they arrived at an answer.

Problem solving is tough like not with regular kids like not in a gifted stream problem solving is very very tough and being able to um show they’re work like a full understanding of how they got an answer. That’s probably the hardest part.
(Sybil, 2015)

These difficulties with word problems demonstrate why I think we need to explore new approaches to problem solving. Since both the quantitative national results as well as some actual educators working in this field see this as an issue, it indicates a growing need.

4.2.2 Student Strategies Solving Math Word Problems Before and After Drama

As part of my research question I wanted to know what strategies teachers perceived their students were using to solve problems and if those strategies would differ while in role.

Sybil stressed that her students need tools like anchor charts, concrete examples, technology, and a lot of scaffolding to be successful. She also included that while those are the general strategies, each child also uses their own. “I mean kids can solve in so many different ways and it doesn’t even necessarily need even be the way I’m thinking about doing it” (Sybil, 2015).

Edith found that breaking down the problem by understanding what the language meant in the question was a strategy she felt helped her students. For example, she mentioned that they talk about which words indicate the operation that will be used in a problem. The students also found the acronym ICE (Illustrate, Calculate, Explain) to be helpful. Additionally, she shared that her students also use a variety of individual strategies depending on their preference or what is needed for the problem.
Mary’s students’ strategies included writing down the data, looking at similar problems to help understanding, and working with classmates.

To my surprise all of the participants believed that the student’s strategies would remain the same when in-role. Edith thought that giving the students the numbers after they had discussed what they kind of information they needed to solve the problem alters the strategy to some extent, but once they had the numbers they would be using the same tactics.

4.2.3 Student Understanding

Going into these interviews I hoped that the educators would predict that the drama would help in student understanding. Unfortunately Edith and Mary both believed that the drama wouldn’t actually improve student understanding. Despite recognizing that it may increase student engagement, Mary could not see how the role-playing would increase comprehension:

It is fun it would be it is fun…but then how's it going to help a student who doesn't understand a problem or maybe doesn't know how to do the problem? I don’t see the relation of how it's going to have student solve the problem.
(Mary, 2015)

While talking to Mary, she reiterated this thought many times indicating that she could not see how this would aid student’s understanding.

Edith also determined that drama wouldn’t actually help student understanding:

I don’t know if uh if the role-play is actually going to help them solve the problem. I--I don’t think so. I don’t think so. Because the gaps in their learning, they’re still going to be there. They still won’t know what to do.
(Edith, 2015)

In fact, she thought that for a student who was really struggling to grasp concepts this might just make the problem even more complicated for them. By bombarding them with more information she believed it might just confuse them.
Mary and Edith’s predictions do not align with the research on drama and situational learning. For example, researchers DeNeve and Heppner (1997) found that role-play simulations enhanced student learning, and that students retained more knowledge from simulative activities. Despite Edith and Mary’s predictions, I think it would be valuable to see how it would change after actually observing a lesson utilizing drama and math. Both educators admitted that they don’t truly know because they had not actually seen anything like it in action.

Sybil’s thoughts on this diverge from the others. She believed that with the necessary scaffolding students would have an easier time understanding the word problems. Additionally she felt that including an element of student research would also help clarify the purpose for students.

Giving them an element of research in this activity would be a good idea too. Not giving them the numbers but giving or guiding them to here is where you can find them. So if you give them that then the purpose I think would be a little bit more clear for them. (Sybil, 2015)

4.3 Benefits of Using Drama in Math

4.3.1 Student Engagement

Although all three participants said that on average their students’ showed relatively high engagement in their mathematics class, they believed that drama would have a positive impact on their students’ engagement. This perception aligned with the texts in my literature review, which state that role-play provides the opportunity for students to engage with the material while stimulating their interest (Bolton & Heathcote, 1999).

Mary thought that the engagement of her class would increase because they all take on a role and are all actively participating. She also assumed that her students would find the lesson enjoyable.
Edith also thought that her students would enjoy the lesson. She believed that both kids who excelled in math and those who struggled would want to participate in this lesson, she did think that some students who are not confident in drama would feel very anxious about the lesson and might not respond positively.

Those kids who are—who like math they’re going to be excited, those kids that have difficulty with drama and may like math but they may not like drama so then they’re going to be kind of tense about the situation, and then the kids who have difficulty in math I think that they’re going to like be happy.

(Edith, 2015)

Sybil thought her students would engage well knowing there was a goal and purpose to the role-playing. Additionally, she felt that since the lesson did not involve the textbook, her students would be very interested in solving the problem: “Once you get rid of the equation of the textbook, they’re a lot more giving in problem solving especially with the [gifted] kids I was teaching” (Sybil, 2015).

4.3.2 Situational Learning

As mentioned in my review of the literature drama provides opportunity to explore real life situations and practice solving real problems through simulated experience (Cheng et al, 2010). This allows students to engage in their learning as active contributors in an authentic way. Two of my participants noticed and found this aspect very beneficial to their students. Sybil in particular felt that connecting learning to the outside world was so important in education:

Kids buy into real life stuff versus textbook questions. That’s boring it’s not relatable…they’ve [textbooks] got all these problems at the end of each unit to show that they have understanding of what it is. It’s so unrelated it’s unbelievable.

(Sybil, 2015)

She continued by talking about how she brings real life problems into her classroom because if it isn’t real her students “see right past it”. This claim also aligns with my theoretical framework. Lave & Wenger (1991) argue that learning should be authentic. When students work
in contexts that reflect real life they are more likely to develop understanding and feel engaged in
the content. She appreciated the fact that within the drama students are able to solve real
problems with real facts and numbers.

    I think again if it’s authentic and it’s based on real research and using real numbers and real
facts and scenarios, I think react a lot stronger than if it was just made up situations. I think
that’s probably my most general statement for you. Kids need authenticity in any subject
especially in math, because they like math.
(Sybil, 2015)

    Sybil also stressed that kids need to be cognizant and make informed decisions. She
explained that we teach them how to do that by giving them the opportunity to gather real
research and debate multiple perspectives in the context of topical and authentic experiences.

4.3.3 Aiding Communication and Promoting Collaboration

    A theme I hadn’t anticipated was that drama is a great tool for students who have trouble
communicating in writing. During her interview Sybil echoed this sentiment discussing how
drama is a great way to help students who struggle with “pen to paper” to show their
understanding.

    Kids who…have difficulty communicating and writing they are able to take that role and
you can assess them in that way too. So they may be able to say more in role than they
could writing down in an answer or a journal question. So yeah I think it would be very
effective to use it.

Additionally, she felt that drama could help students in special education who have difficulty
communicating, shine.

    According to Edith, the drama would also be beneficial because communicating in
groups is also a great way to promote understanding. The nature of role-play in the classroom is
often collaborative. Schneider and Jackson (2000) found that working in role allowed students to
learn from the interactions with both the teacher and classmates. Working in role with another
person helps move the drama forward. In this situation, the collaborative environment can
benefit the learner. Edith continued to say that problem solving in groups works because students have the opportunity to “feed off each other”.

### 4.4 Obstacles for Drama/Math and Teacher Suggestions

#### 4.4.1 Time Constraints

All three participants of this study identified time, in some capacity, as a clear obstacle for the utilization of drama within the math classroom. This was not surprising to me because I too have noticed during my teaching experiences how difficult it can be to implement drama strategies within the allotted time. Edith recognized two major manners in which time can be a huge limitation for its incorporation. Firstly, she spoke about the amount of time it would take to prepare for a drama lesson. As a teacher who has little background in drama, devising an effective and meaningful drama and math lesson would be a challenge that would likely take considerable time during after school hours. Secondly, Edith discussed the restricted amount of time allotted for each mathematics class. With all the curriculum expectations that a teacher must cover, a lesson like this, which would take at least an entire period if not more, might not always be the best use of limited time. In her study Greenwood (2010) similarly found that the pressure educators feel to cover the curriculum content makes it difficult for educators to justify incorporating the arts into their lesson plans.

This was a sentiment echoed by Mary:

> I saw in your lesson that this was one hour for one problem. It is going to take you forever. I mean I have a curriculum I need to finish by the end of the year. I would say in one hour I could maybe do five or six problems.  
> (Mary, 2015)

She believed that an entire lesson devoted to one overarching problem was not sufficient for the amount of material she need to cover. For both these educators this pressure to achieve all
objectives in the curriculum within the school year is somewhat a deterrent for using drama, which can be time consuming.

Sybil also found that time makes implementing drama in the math classroom challenging. She believed that in order for authentic and meaningful exploration of the role-play and mathematical problems, this lesson would need to take place over several days. When there is only 50 minutes in a period it becomes challenging to accomplish everything because authentic drama experiences take time to create. This would cause complications depending if any students were absent during that time and how frequently the teacher saw their students.

4.4.2 Lack of Resources and Space and Groupings

An obstacle that was brought to my attention through these interviews was the lack of resources teachers have to actually implement drama in the math classroom. For an educator who has no experience with drama it may be very challenging to design meaningful lessons that incorporate both good drama and math without or very little guidance. In our interview, Edith expressed a desire to try combining math and drama, but found that the lack of resources would be a huge roadblock.

You know, where are you going to find them? They’re not in math books, they’re not in math work books… I mean so having a bank of these, if there were, um yeah you know once a month to do it in my class? Sure!

Although there are resources out there for drama online, they most likely are not integrated into math and are time-consuming to find. Edith expressed that if she had a resource that was easily accessible demonstrating how one could incorporate drama into math she would definitely try it.

4.4.3 Need for Scaffolding and Good Rapport

When I devised a lesson plan that incorporated math and drama I intended for it to be a snapshot within a larger unit. For this reason there is a lot of background information and prior
knowledge that would have to be developed before this lesson could be successful in a classroom. Two of my participants recognized this as something that would need to be addressed. Sybil in particular felt strongly about ensuring the students have the necessary scaffolding before the lesson is implemented:

   To have that authentic kind of dialogue you definitely need to have tons of background. Throughout the interview she reiterated how essential scaffolding was to ensure that students would be receiving the benefits of the lesson. Edith also felt that a lesson like this would require the necessary background knowledge on both the roles they were playing and on the mathematical concepts. Both educators agreed that this lesson would take place either in the middle or the end of a unit.

   Sybil also felt that in order for this lesson to be successful a teacher would have to have good rapport with their students. Clear expectations must be defined and followed in order to ensure that the lesson and learning are taken seriously:

   When you think about drama it's also play for them so when you tackle drama with a purpose you have to establish like a really strong classroom rapport so it doesn't get silly and goofy and they just fake it for fun.

   This relationship would likely have to be developed prior to implementing this lesson.

4.5 Summary

   Sybil, Edith, and Mary all provided insight into the perception of drama and in particular its possible use within the mathematics curriculum. They discussed their attitudes and comfort level toward the utilization of the dramatic arts within the mathematics classroom, the effects they predicted on students’ use of strategies and understanding of math concepts within a drama lesson, some benefits they believed drama could have for students, and what challenges they foresaw to it utilization. In the following chapter I discuss the implications my findings have on
myself as a researcher and teacher, as well as on the broader educational community. I will also discuss any areas for further research.
Chapter 5: Discussion

5.0 Introduction

The purpose of this research study was to examine the effects teachers perceived an in-role drama and math lesson had on their students’ engagement and understanding in math. Additionally my sub questions were How might students respond to the use of drama when discussing a math word problem? and How comfortable is the teacher with using drama in their classroom? Within this chapter I will discuss my main findings and their significance, the implications these findings have on the broader educational community and myself as an educator and researcher, and the recommendations I have for the community based on my findings. Additionally, I will also discuss areas for further research that I have uncovered after carrying out this research project.

5.1 Discussion

The previous chapter was organized into four prevalent themes that emerged from my interviews. These themes were teacher comfort and attitude, student strategies and understanding, benefits of using drama in math classrooms, and obstacles and teacher suggestions. Below I will reiterate my key findings along with their significance. It is important to state that since this study only includes three participants, the findings are merely a small perspective on this topic and cannot be generalized.

5.1.1 Comfort Level and Attitude are Intertwined

Through the interviews with my participants I found that their comfort level with what drama was and utilizing drama in their classroom seemed to be related to their attitude toward its usefulness. If the educator felt comfortable using drama they appeared to have a positive attitude toward it, but if they didn’t feel comfortable with it they didn’t see any value to it.
I don't think so. I mean, no I don't think so. If I'm going to get somebody-- if I'm going to get somebody to be the sale person to sell cupcakes I don't know this is drama. I don't know which category would use that in (Mary, 2015).

As evidence by this quote, Mary doesn’t appear to have much experience or comfort in drama. Later in the interview she expressed that she didn’t see its value. “My reaction was it is not going to help” (Mary, 2015). It seems clear here that Mary’s comfort level predicted her attitude toward its use. This has significance because regardless of the perceived or actual benefits of drama, if a teacher is not comfortable implementing it they are likely not to.

5.1.2 Stigma of Drama in Education

An important finding that arose from this study was the recognition of the stigma attached to using drama in the classroom. All of the participants spoke to this notion that drama is often only considered for play.

So for them its like “Aw yay”, you know, “we get to, you know, fool around now, we get to play” because, you know, people kind of have this vision of drama is when they have fun. Which it is, it is fun so for some kids it might be, “Oh I’m not going to do any work” (Edith, 2015).

This vision as Edith describes sees drama as a time to have fun and is not associated with what we consider work. This is significant because this stigma could potentially inhibit educators from using drama in their classroom despite their perceived benefits.

5.1.3 Perception of Understanding and Engagement

Central to my research was uncovering whether teachers believed drama would help student understanding of math concepts. Two educators in this study did not see how the drama lesson provided would help their students understand the math.

It is fun? It would be, it is fun…but then how’s it going to help a student who doesn't understand a problem or maybe doesn't know how to do the problem? I don’t see the relation of how it's going to have student solve the problem (Mary, 2015).
This is contrasting to current research that suggests drama can promote understanding in other subject. In Rosler (2008) she found that drama helped students combine and understand different texts in her social studies classroom. This may suggest that though drama fosters understanding in subjects like social studies or English, math may not share the same benefit. However, it is important to mention that these are only perceptions of understanding.

The other important question to my research was what effect they perceived drama to have on their students’ engagement. Despite the belief that drama would not increase student understanding, the educators in this study unanimously agreed that drama would be beneficial for student engagement.

I think the engagement will increase because they will all be having a role and they will be doing something... Yeah so somebody who is not interested will just be excited and want to know what's going on that is why it would increase engagement (Mary, 2015).

These predictions echoed the current research. In Dorian’s (2009) study he found that his students had a very enjoyable engaging experience in science when combined with drama. Although the participants didn't believe drama would promote understanding, I found it profound that they thought it would still increase their engagement. In order for any understanding to be developed in the first place our students need to be involved in the learning experience. I would argue that a child who is disengaged from a lesson that explicitly breaks down a math problem step by step is also not promoting the understanding for that child. Dorian (2009) mentions in his study that his students were so involved with the lesson that they had a high self-perception of their understanding. The fact that drama would provide the opportunity for engaged learning is cause to belief that their potential for developing understanding would increase.
5.1.4 Situational Learning

A key finding that also aligned with my literature was the connection between drama and situational learning. Sybil, believed that taking on a role and immersing the students in simulation of a real life situation would help student understanding and make connections to their real life. The situated learning theory framework lends itself to this idea that connecting learning to real life situations is essential for student knowledge and learning (Lave & Wegner, 1991). In Cheng et al.’s (2010) study which had nursing students practice problems in role they found that the situational learning opportunity helped them make the connection between theory and practice. This is significant because drama can be used as a pedagogical tool to help students make those essential real world connections.

5.1.5 Obstacles and Teacher Suggestions

The participants in this study believed that the major challenges to using drama in the math classroom is the lack of resources and the amount of time it takes to accomplish. Greenwood (2010) talks about both these challenges to the utilization of drama in her article on drama in education in New Zealand. “Primary teachers find that pressure to teach the entire curriculum leaves, regrettably, little room for the individual arts” (Greenwood, 2010 p. 71). This pressure to cover the material in a certain time makes it so teachers are less likely to implement strategies like drama into their classroom, and without the adequate resources, even more so.

5.2 Implications

The implications of my findings are divided into two subsections. First I will look at what this research means for the broader educational community, then I will explore what this research means for me as an educator and research.
5.2.1 Broad: The Educational Community

The research I have gathered through this study has multiple implications for the greater educational community. Throughout this section I will uncover what my findings mean for teachers, principals, and teacher education programs.

The stigma against drama is a challenging obstacle for the proliferation of drama in the classroom. This idea that segregates “work” from subjects like drama seemingly perpetuates traditional methods of teaching in our education system. While the stigma continues to stand, educators are more likely to avoid using drama in favor of traditional pen to paper work and thusly their students are missing out on the possible benefits of drama. This means that we need find ways to break down these stereotypes in order to provide our students opportunities to be active learners.

The benefits suggested by the participants indicate that despite some of their hesitations they do see value in using drama in the math classroom. Firstly, the teachers believed that drama would positively affect their students’ engagement. Researchers Bolton and Heathcote (1999) also believed that by stimulating student interest through in-role activities their learning potential would increase. This means that drama could be used as a tool to engage all learners in complex material. This implies that using drama in math classrooms would help engage students in their learning experience and thus strengthen their learning experience.

Secondly, another benefit suggested was that drama provided a space for students to simulate real world experiences in their learning and make those essential connections. According to the Ministry of Education’s (2005) Mathematics Curriculum document this is an important element to mathematics education:

It is important for teachers to use a variety of instructional, assessment, and evaluation strategies, in order to provide numerous opportunities for students to develop their ability
to solve problems, reason mathematically, and connect the mathematics they are learning to the real world around them. Opportunities to relate knowledge and skills to wider contexts will motivate students to learn and to become lifelong learners.

This means that educators can utilize drama in order to meet these expectations laid out by the curriculum and help students make those important connections to the real world.

The implication of these two elements for educators is substantial. As teachers we must work to bring to life the material we teach our students. The movement away from traditional classroom instruction focusing on content only, to the development of research and application skills that situate student learning means that we need to change our approach. Drama can do this for students because it both is engaging and fun, and if done effectively can help students connect with the real world. By allowing students to simulate real world problems, they can begin to make connections and see how concepts from the classroom relate to real world. If our focus must be on creating these opportunities, particularly in math, the implications of drama for the educational community is profound.

The obstacles to utilizing drama as indicated by my participants are obstacles that are also challenging for the implementation of many alternative approaches such as. The implication of this is that in order for teachers to break the mold of traditional teaching methods they need the adequate support and training. This means that the support must come through policy, the school boards, and the administration.

For principals this research study bears some implications: in particular the obstacles to using drama in the math classroom indicate that principals need to provide support for their teachers. Firstly, for drama in mathematics classrooms to work principals would need to provide their teachers with the necessary resources. Without the appropriate access to resources and
professional development teachers will revert to the methods they have used before. This attitude does not promote furthering of educational pedagogy.

Secondly, the lack of time for drama seemingly due to the pressure to cover a lot of material over the year indicates that in order for drama to flourish in schools principals need to foster a school wide attitude that values inquiry and situational learning. By doing this teachers might feel more comfortable spending their time on a couple bigger problems that involve drama instead of multiple problems that don't. This also means that they need to ensure that teachers are accountable for upholding these proven beneficial values.

Finally, for teacher education programs this research study indicates that we need to teach teacher candidates strategies for using drama in their classrooms. Many teacher certification programs only offer drama to students who request it, in contrast to subjects like music and art which all students are required to take. The lack of comfort the teachers in this study expressed could be rectified if candidates were provided opportunities to develop these skills before they receive their own classrooms.

Overall, the findings of this study suggest that drama does have a place within the mathematics classroom in some capacity.

5.2.1 Narrow: My Educational and Research Practice

I went into this research endeavor very confident in the importance of drama and how it has the potential to change things. The implications of my findings in my practice mostly further strengthen my belief in drama integration in all subjects. After listening to educators who had some to little experience with drama talk about the potential benefits made me hopeful for breaking down the stigmas and stereotypes surrounding it.
The benefits suggested by the participants indicate that despite some of their hesitations they do see value in using drama in the math classroom. This indicates that the perception of drama, while not by any means perfect as indicated by Mary and Edith, is not completely negative. Teachers who have little to no background can see how drama might make lessons engaging and fun. As a drama advocate this is hopeful. It means that my work in drama in education can potentially have an impact on teachers and students.

As an educator these benefits imply that I should implement the practice of drama throughout my classroom and in particular mathematics. As suggested by my participants and the current research, drama can positively affect student engagement as well as provide a space to make those important real world connections.

This study has enlightened me to the challenges I may face when trying to utilize drama in the classroom. Though I predicted these difficulties, hearing them first hand by educators currently teaching it contextualized and solidified my suspicions. As a researcher this means that in order to continue to improve drama in education, the appropriate support needs to be developed and uncovered. This means for me that I need to continue to work toward acquiring and developing this support for both my fellow educators and myself.

5.3 Recommendations

Based on my research findings I have two recommendations. Firstly, in order to support teachers who wish to use drama in the math classroom, resources must be developed. My recommendation is that the Ministries of education or individual school boards develop resources that can help teachers use drama across the curriculum including in math. Any already existing resources should be made easily accessible by teachers online through their school boards website. Additionally, groups like the Council for Ontario Drama and Dance Educators (CODE)
should develop lessons that can be utilized in a variety of mathematic strands. Secondly, pre-service teaching programs need to incorporate drama in education into their courses. By providing teacher candidates the knowledge and skills to use drama in their classroom, I predict they will feel much more comfortable actually implementing it. I suggest these programs create a course in this subject that focuses on integrating drama across the curriculum. These recommendations will potentially make it so drama in education is easier to implement seamlessly into the classroom.

5.4 Further Research

This research study has uncovered new questions that I hope one day to explore in order to further this field. These questions are:

- How can we change the stigma around subjects like drama?
- How can we increase teacher self-efficacy in drama?

Additionally, in order to further the research of this study I believe it would be meaningful to do a mixed methods follow-up where teachers actually implement the lesson I provided them in order to confirm or deny their predications. This study would also ideally include more participants and actually gather data from the students themselves. The focus as with this study would be to see the effects and in-role drama lesson had on student engagement in and understanding of math material.

5.5 Conclusions

The intention of this study was to observe the perceptions teachers had on the use of drama in the mathematics classroom and identify there own personal attitude and comfort level with it. It is rooted in the idea that drama is a beneficial educational tool that can enhance the educational experience. Since students in Ontario have been struggling with the subject in
particular word problems, drama seemed like a viable strategy to engage and improve student understanding.

Overall there were five main findings of this study. Firstly, the teacher’s comfort level with drama was correlated with the teachers’ attitude toward it. This indicated that educators need to feel comfortable with they drama if the are ever going to utilize it. Secondly, there is a stigma that drama is only for play. This attitude also affects whether a teacher will use it in their classroom. Thirdly, the teachers perceived that drama would not increase student understanding, but would have a positive impact on student engagement. Though they could not see how it could aid understanding, it could be argued that increasing student engagement could lead to a better understanding simply because students are more focused on and active in their learning. Fourthly, drama offers a space to engage critically with real life problems and develop connections between content and the real world. And finally, despite its benefits drama can be challenging to implement due to the lack of resources and time in a classroom. Accompanied by the demands to meet all curriculum expectations.

These findings are important to the educational community because it offers an alternative approach to mathematics education. It allows students to engage and connect in a way they cannot achieve through seated work. Bolton and Heathcote (1999) claim that role-play can enhance learning because it gives students the power to engage directly with the material. This action and engagement can potentially transform the mathematics classroom especially for those learners who struggle. Though there is still much research to be done in order to truly confirm these findings, it is significant that educators with little experience with drama and some with attitudes against it did see some potential. With these lessons in mind that encourage the use of
drama, I hope to continue finding ways to incorporate drama and make mathematics education meaningful.
References


Appendix A: Letter of Consent for Interview

Date: ___________________

Dear participant,

I am a graduate student at OISE, University of Toronto, and am currently enrolled as a Master of Teaching candidate. I am studying the perceived effects the use of drama within the mathematics classroom has on students for the purposes of investigating an educational topic as a major assignment for our program. I think that your knowledge and experience will provide insights into this topic.

I am writing a report on this study as a requirement of the Master of Teaching Program. My course instructor and supervisor who is providing support for the process this year is Peter Joong. The purpose of this requirement is to allow us to become familiar with a variety of ways to do research. My data collection consists of one interview that will last up to an hour and will be tape-recorded. Prior to this interview you will receive a lesson plan that you must kindly read. I would be grateful if you would allow me to interview you at a place and time convenient to you.

The contents of this interview will be used for my assignment, which will include a final paper, as well as informal presentations to my classmates and/or potentially at a conference or publication. I will not use your name or anything else that might identify you in my written work, oral presentations, or publications. This information remains confidential. The only people who will have access to my assignment work will be my research supervisor and course instructor. You are free to change your mind at any time, and to withdraw even after you have consented to participate. You may decline to answer any specific questions. I will destroy the tape recording after the paper has been presented and/or published which may take up to five years after the data has been collected. There are no known risks or benefits to you for assisting in the project, and I will share with you a copy of my notes to ensure accuracy.

Please sign the attached form, if you agree to be interviewed. The second copy is for your records. Thank you very much for your help.

Yours sincerely,

Researcher name: Cassandra Carvalho

Phone number: 1(519)567-0542
Email: cassandra.carvalho@mail.utoronto.ca
Instructor and Supervisor’s Name: Peter Joong  
Phone number: (416) 221-9917  
Email: peter.joong@utoronto.ca

Consent Form

I acknowledge that the topic of this interview has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw at any time without penalty.

I have read the letter provided to me by Cassandra Carvalho and agree to participate in an interview for the purposes described.

Full name (printed): ______________________________

Signature: ______________________________
Appendix B: Interview Questions:

Background Information:
1) How many years have you been teaching?
2) Over the years, what grades and subjects have you taught? Of these which do you feel most comfortable teaching?
3) How would you describe your students’ typical engagement in the subject of mathematics?

Teacher Practices (What/How):
4) Can you please describe what a typical math lesson looks like in your classroom?
5) Are there any areas or strands within the subject of math your students have difficulty?
   Any areas of strength?
6) How do you typically approach teaching mathematical word problems in your classroom?
7) What are the strategies your students use to solve mathematical word problems?
8) Do you have any experience with drama outside of your classroom?
9) Do you use drama in your classroom? If so how?

Beliefs/Values:
10) What was your reaction to the lesson you received before during and after reading it?
11) How might your students respond to the use of drama when working on a math word problem?
12) If you were to use this lesson in your classroom would your students’ engagement increase, decrease, or remain the same as a typical lesson.
13) Do you think the students’ strategies for solving math problems would differ from normal when in role? If so how?
14) Do you believe the role-play would be effective or ineffective for helping your students solve word problems? Why?
15) Do you think there are benefits of using drama across the curriculum?
16) Are there any benefits of the drama lesson that you can predict? Any negative aspects?
Next Steps/Challenges:

17) Does the role-play used in this lesson seem “doable”? Why or why not?
18) Would you feel comfortable implementing this lesson in your classroom? Why or why not?
19) What would you change about this lesson to improve it?
20) After evaluating this lesson, has your perception of drama in education and in particular within math classrooms changed or stayed the same?
21) What are the challenges involved in utilizing drama across the subject areas?
22) Are there any challenges you believe there are to using drama specifically within the math classroom?
## Richards Manufacturing Wants an Energy Change

**Grade 6 Number Sense and Numeration and Drama**

### Curriculum Components

**Overall Expectations:**

**Number Sense and Numeration:**

Solve problems involving the multiplication and division of whole numbers, and the addition and subtraction of decimal numbers to thousandths, using a variety of strategies;

**Drama**

B1. Creating and Presenting: apply the creative process to process drama and the development of drama works, using the elements and conventions of drama to communicate feelings, ideas, and stories;

### Specific Expectations:

**Number Sense and Numeration:**

- solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 1,000,000
- solve problems involving the multiplication and division of whole numbers (four-digit by two-digit), using a variety of tools
- add and subtract decimal numbers to thousandths, using concrete materials, estimation, algorithms, and calculators;

**Drama**

- B1.1 engage actively in drama exploration and role play, with a focus on examining issues and themes in fiction and non-fiction sources from diverse communities, times, and places
- B1.3 plan and shape the direction of the drama or role play by collaborating with others to develop ideas, both in and out of role

### Goals:

By the end of this lesson, students will have demonstrated an understanding of solving a word problem utilizing multiplication, division and addition strategies.

Students will have effectively created and maintained their role throughout the activity.

### Materials Required:

- Chart paper
- Markers
- Name Tags
- Bell or other indicator
- Teacher Guide Sheet (found below the lesson plan)
**Prior Knowledge:**
Students will activate prior knowledge about what they know about different types of energy sources and multiplication division and addition of whole numbers.

<table>
<thead>
<tr>
<th>Minds On</th>
<th>Review: Briefly review previously learned material by asking students to answer questions utilizing as many strategies as they can think of in pairs. Have students share their responses with the class. Here are some examples of questions.</th>
</tr>
</thead>
</table>
| Timing: 10 min | 4302 x 4 = 17,208  
2178 x 20 = 43,560  
4404 x 13 = 57,252 |

<table>
<thead>
<tr>
<th>Action:</th>
<th><strong>In Role Problem Solving</strong> Explain to students that they will be participating in an in role activity. Throughout the duration of the activity they must give themselves a character based on the occupation they are given and remain in role until the activity has finished or unless there is some type of emergency. For example, if told they will be police officers they must create a character that is a police officer. Make sure to tell students that they should think about why their character chose that field of work. Utilize some sort of indicator (bell noise etc.) to let students know when the drama has begun and finished.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing: 35 min</td>
<td>Once students have an understanding of those expectations use indicator (ex. ring the bell) and begin. Teacher should also join in role.</td>
</tr>
</tbody>
</table>

The following steps will have a small script for the teacher to use while in role. This is meant as a guide and does not need to be followed word for word.  
*Introduction:*  
-Introduce the setting for the problem and also what the students will be in-role as (Energy Experts).

Teacher in-role: “Hello everyone! We here at Richard’s Manufacturing Company thank you for being here to help us with our new energy initiative! I know you are all experts when it comes to energy generation, whether solar, wind etc. so I am looking forward to seeing what you come up with!”

*Mingle to Music:*
-In-role have students walk around the room introducing themselves as their character. Before this activity give students a couple minutes to name their character and think about why they chose to go into the energy field.

Teacher-in-role: “Before we get to our problem I want to give you a chance to talk a little bit about yourselves! I have placed some nametags at your table, so if you could please fill those out and think about what made you want to become an energy expert. Now why don’t you all take a moment to walk around the room and introduce yourself to a few people here today? I will play some music while you walk around and when the music stops tell the person closest person to you your name, where you are from, and why you came here today! We will repeat this process a few times so you can talk to some different people. Any questions?”

**Team Problem Solving**

- Have students split into teams of two or three and answer the problem on sheets of chart paper: “Which source of energy (wind, solar, coal) would be the most cost effective for Richards Manufacturing Company?”

Teacher-in-role: “Okay, thank you for your participation! It was great to get to know some of you. Now let’s get to why I have asked you all here. We here at Richards Manufacturing are looking to change our current source of energy. We would like to invest in renewable energy to power our company, but we don’t want to be spending any more money than we are now using coal generated power. So what we would like you to do is determine which source of energy between solar, wind, and coal would be the most cost effective for us! If you have any questions please feel free to ask. Also when you decided what kind of data you need to solve the problem please ask. I will give you the numbers from our research report. So if you all could get into teams of two or three and come grab a marker and a piece of chart paper so you can get started on the problem. Please try and make your calculations easy to read because you will be presenting your findings to the group.”

- While students are working on solving the problem walk around the room and provide any support. Try and allow for students to determine the steps and information they need to answer the question, but give them more guidance if necessary. If students are not advanced enough yet to start without any data provide them with the data on the Teacher Guide sheet below. Also while circulating ensure that students are remaining in their role.

<table>
<thead>
<tr>
<th><strong>Consolidation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing:</strong> 15 min</td>
</tr>
<tr>
<td>- Have students present their findings to the class in their role by discussing what they found and more importantly how they found their answer.</td>
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</tbody>
</table>

Teacher-in-role: “Alright, since everyone has finished their calculations, let’s see what all you experts have come up with so we can determine which energy source
we should be using.”

- After all have presented determine as a class the best source for the company and thank everyone for helping to solve this problem. Once thanked use indicator to signal that the drama is over.

| Assessment       | - Observations throughout lesson.  
|                  | - Chart paper students used to solve problem. |

| Next Steps       | During the next lesson the class will determine which strategies to solve the problem were the most efficient. |

This lesson is at least an hour. Depending on the ability of the class, more time might be needed. In this situation, utilize your indicator to bring you students out of role during their problem solving. When you return to the lesson remind students of the expectations of being in role, utilize the indicator to bring them back into role, and briefly welcome them back in role before they return to their teams to work on the problem.

This structure of lesson could be done with many other topics and should ideally be catered to the classes specific interests.
Teacher Guide

The company has $60,000 to spend on this initiative.

Wind Energy

Each wind turbine costs $5,400 to purchase and install.

Richards Manufacturing will save $150 a month per turbine.

Solar Energy

1 bundle (5 solar panels) cost $4550 to purchase and install.

Richards Manufacturing will save $125 a month per 5 panels.

Coal Generated Power

No installation fee since they already are using this.

Costs $1000 a month for its power.

Guiding questions

How many wind turbines can the company afford? How much money will they have spent and left? Answer: 11 R 600; 59,400

How many bundles of solar panels can the company afford? How much money will the company have spent and left over? Answer: 13 R 850; 59,150

How long will it take the company to make back the money spent on installation fees? Wind: 3 years. Solar: 3 years 1 month

- How much money will the company save over each month? 3 months? A year?
  - Wind Answer: 1,650; 4,950; 19,800
  - Solar Answer: 1,625; 4,875; 19,500

Students should determine that wind energy is the best option. Although the upfront cost is more, in the long run the savings will be more.