

## **“Without Emotion, There Is Nothing Left But Burden”: Teaching Mathematics through Heathcote’s Improvisational Drama**

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### **Abstract**

This paper justifies the use of Heathcote’s whole group improvisation drama in mathematics education and gives mathematical and non-mathematical examples. It is suggested that this technique for teaching curriculum through the medium of drama in an ‘as if’ setting engages students through immersive emotional and contextual modes of understanding.

### **Why Use Drama in Conjunction with Mathematics Education?**

It is still considered an unusual idea to teach mathematics via the arts; and where the arts have been accepted into mathematics instruction, it is far more likely that they will be visual and sculptural media used for representing mathematical objects and relationships. It is not an enormous leap from drawing diagrams to making paintings, or from making models to sculpting them. Similarly, digital versions of painting and sculpting (and rotating those sculptures through digital animation) are more commonly accepted in the more conservative realms of mathematics education than are the performing arts: music, dance and drama.

Of these three areas of the performing arts, drama might again seem the hardest ‘sell’, since it is particularly difficult to represent mathematical entities directly in a dramatic medium. Drama depends on character, dialogue, human interactions and emotions, and the abstract nature of mathematics has sometimes been seen to preclude these.

For many learners, however, the removal of human relationships and emotions from mathematics leaves the discipline feeling cold and uninhabited. We are, after all, living human beings, and although mathematics can be treated abstractly, it has arisen (and continues to develop) through human interactions with the conditions of life. On occasion, it is important to recontextualize the abstract patterns of mathematics in their human setting, whether through acknowledgement of its history (see Fauvel [1]), or its cultural aspects (for example, through ethnomathematics (D’Ambrosio [2]; Gerdes [3])). For learners who need to know the human side of things (and that includes most learners), making connection with the ‘people side’ of mathematics can give a sense of purpose and appreciation to the study of patterns in the abstract.

There are many ways that drama and dramatic performance can be used in education – for example, skits, improv games, simulation games, scriptwriting, putting on scripted plays and musicals and acting for film are some of the modes of drama and theatre used in school settings, most often in acting and drama classes. Some of these have been adopted for use in the teaching of mathematics. For example, a

math performance contest I have been involved with (<mathfest.ca>) has elicited skits and improv interviews with mathematical objects; a number of writers have written scripted dramas about mathematics (for example, Stoppard [4]; Mighton [5]). I have written and performed my own play about Kepler, and other educators have written plays on topics in mathematics history (see [6], for example).

The dramatic mode I will discuss here is a different from all of the above. It is a uniquely immersive form of drama called Whole Group Improvisation, developed by the British educator Dorothy Heathcote, and it is designed to make use of drama as a *learning medium* (as opposed to drama as training to be an actor, or as a way to put on a show, or as a way to build group cohesion or trust). Heathcote's style of Whole Group Improvisation is well known among drama educators as a powerful medium for teaching and learning any kind of curriculum, but remains little-known among mathematics educators. Having worked directly with Heathcote in England, and having tried several 'math dramas' in this style, I would like to share my experiences with fellow mathematics educators with the aim of collaborating to develop this medium further, and to recognize its potentialities.

### **Heathcote's Drama as Immersion in an 'As If' World**

Dorothy Heathcote joined the Faculty of Education at the University of Newcastle-upon-Tyne in 1964 after training as an actress and working in teacher education at the Durham Institute. From the 1960s to the present, Heathcote has worked in idiosyncratic and unconventional ways to develop a new kind of drama-in-education which she calls Whole Group Improvisation, or The Mantle of the Expert [7]. In this mode of drama, teacher and students all participate in role to create stories and scenes through which students can experience curriculum in an emotionally rich context. The intention in this kind of drama is not to create a play that can be shown to others, nor is it to develop technical theatrical skills in acting, scripting, directing, lighting, etc. The aim is rather to get students to invest care and attention in an 'as if' world – a world that feels as if it were real, even though we know it is not. When students immerse themselves in playing a role in this imagined world, they build belief and feeling for the characters, situations and conflicts of that world, and it is through this belief that learners come to care about the curricular knowledge that they gain through this involvement and the playing out of the drama.

Heathcote's dramas involve play that is qualitatively similar to children's spontaneous role-playing, something all of us have experienced as young children and which is accessible (though rarely accessed) at any later stage of life. The dramas build a feeling of passionate involvement, even though we know that it is ultimately 'just pretend'. The worlds and roles we build take on a sense of reality, and real emotions are played out in these imaginary settings.

In recent years, millions of people have had similar immersive experiences through MMORPGs (massive multiplayer online roleplaying games like World of Warcraft or Runescape) on computers and the internet. Education theorists like Gee [8] and Shaffer [9] have written about the ways that these experiences can support learning through empathetic engagement, virtually embodied learning and the fostering of creativity through identification with a role or character. Heathcote's work predates video games by several decades, and while it shares some of the beneficial effects of immersive online roleplay, it has the added advantages of being locally developed (taking into account the situated resources of the students and their community), being live and physically present for students, and being shaped in real time by all the participants.

Heathcote herself has written about her work, but she is more a practitioner than a writer, and her written works don't do full justice to the power of her inventions and discoveries. Gavin Bolton and Betty Jane Wagner [10], [11] offer coherent descriptions and explanations of Heathcote's work. There is an excellent BBC film available online that shows Heathcote's teaching in action [12]. and a number of other online videos show workshops she has given worldwide.

### **A Methodological Description of Whole Group Improvisation**

The aim of Whole Group Improvisation is to build engagement and belief through roleplaying participation in an imagined world, and to teach curriculum via this engagement. Heathcote develops her dramas in the following way:

- First, it is essential to find the inherent conflict that makes the curriculum compelling. Every topic that we teach in school (in mathematics and other subjects) emerged in human history from some kind of struggle, or has been involved in difficulty or conflict. Finding the conflict that relates to the curriculum is a key to the development of a drama.

- Next, it is important to pay attention to the real life struggles and preoccupations of the particular group of learners in the group. An awareness of their own struggles in life can be woven into the drama, adding subtexts and levels of meaning to the drama.

- Finding a way in (through a scene, a ritual or an encounter) allows learners to begin to enter the world of the drama. Heathcote’s dramas do not typically start at a climactic point, but draw participants into the scene slowly.

- The leader of the drama needs to find ways to slow down the action and to get learners to invest in the drama by the work they do to deepen their understanding of their character. Heathcote emphasizes that she does *not* want learners to move quickly and superficially through the plot of a story, play-acting the action without conviction. Instead she aims for depth of understanding and feeling, and that is cultivated through focus on the key conflict in the drama and its playing-out through a dwelling with the emotions and realizations evoked.

Heathcote’s dramas often involve a great deal of writing, thinking and talking about the dramatic situation, or the preparation of artefacts (props, signs, letters and so on). Everything the students do as part of the drama increases its power and effectiveness, so that they will willingly do curricular work around the dramatic nub of the story in a sustained and engaged way. Participants invest in their roles and thus engage in them (and the curricular ideas connected with them) with greater conviction.

- Finally, the leader of the drama needs to identify the moment of greatest conflict, and push participants toward it, and slowing down the action at the moment of most intense drama so that students can explore that moment emotionally and in depth. If the drama is effective, students will reach moments of insight, where the reasons for learning the curriculum become evident. The aim here is to work in depth, rather than to try to ‘cover’ a great many topics more superficially (although there may well be a place for a broader coverage of curriculum in other kinds of classroom activities).

Heathcote has written that “without emotion, there is nothing left but burden”, and this to me is one of the most moving indictments of contemporary schooling that I have encountered. In so much of our educational system, we have tried to remove emotion (in order to be ‘scientific’, objective and impartial), but in doing so, we have also removed meaning, and left nothing but the burden of facts and algorithms to be memorized and ultimately forgotten. Heathcote’s emotionally and intellectually engaging drama brings back emotion, context and meaning to curriculum.

### **Two Examples of Non-Mathematical Dramas in Heathcote’s Tradition**

As graduate students in Applied Linguistics at the nearby University of Durham, England in 1989/90, my husband and I were eager to learn more about Dorothy Heathcote’s teaching techniques. We were lucky to have the chance to spend two days working on a drama with Heathcote and then to spend another day interviewing her at her house. Following that experience, we led a half-day drama at our university as part of my husband’s Masters thesis research (Byrne [13]). I will give a brief description of these two dramas (which dealt with curricular topics in language and culture), as a prelude to a description of two mathematical dramas I later developed and led.

Dorothy Heathcote had been commissioned by the British Council to lead a drama as part of a summer course for international teachers of English as an additional language. There were 60 English teachers from all over the world coming to Durham for summer language courses, to polish their own language skills (since all of these teachers spoke English as their second language).

Heathcote was aware that these English teachers would have some difficulty in understanding the accents and dialect of local people in the Durham and Newcastle area, especially working class people who were very much grounded in local culture and traditions. She was also aware that they would encounter some level of xenophobia, particularly because there was a fear of ‘foreigners’ bringing in diseases like AIDS. At the same time, the visitors to England would have had fears about contracting Mad Cow Disease (bovine spongiform encephalitis) which was infecting many in Britain at the time.

The British Council asked Heathcote to address curricular aims around learning language functions through interaction. The English teachers were to learn how to negotiate, interrupt, deal with disputes and make a cogent argument with fluency in the context of verbal conversation. They were also supposed to become aware of the varieties of English used in the local area and to learn more about British culture and traditions.

Heathcote brought all these elements together in a two-day drama set in 1593, on the eve of the first production of Shakespeare’s *Romeo and Juliet* at the Globe Theatre. The drama involved 120 people: sixty 11-year-old school children from two classes at a local school in working class Gateshead, and sixty international teachers of English who had just arrived in England for their summer course with the British Council.

The first day of the drama involved only the children, and was held in their school classrooms. The students were told that they would be involved in a drama about Shakespeare’s England, and that they were to be the townfolk of London. Each one of them had to have an occupation and prepare props and ways of announcing their work to the public. The students took on the roles of merchants and artisans: pie-sellers, barbers, carpenters, tailors, furriers, milliners, fruit sellers, book sellers and rat catchers. We observed their work as they made and decorated trays of corrugated cardboard that hung round their necks to display their wares. Students practiced the calls they would use to attract customers at the market: “Pies! Fresh pies! Only the best meat in these pies – not like the other fellows”, or “Fur hats! Keep your head warm in the winter! Don’t freeze, wear my hats!”

On the second day, the sixty children, speaking in strong local Geordie dialect, met the sixty adult English teachers, most of whom had never been to Britain previously. We were working in a local church hall, a large bare room with a few tables and chairs.

Heathcote told the adults that they were a travelling troupe of actors in Shakespeare’s company, and that they would be putting on the debut performance of *Romeo and Juliet* later that day. However, before they could rehearse, they would have to find themselves places that would offer room and board to an itinerant actor – and actors were not well-regarded in those times. Furthermore, the actors would not be paid until after a run of performances, so they would not be able to pay for their accommodations until the end of their stay. They were coming to the Bartholomew Fair to barter with the local vendors for a place to sleep.

The merchants (the local school pupils) set up booths with the wares they had made on the previous day, and they called out their wares to the market. They had been instructed to drive a hard bargain with the actors, and in this scene, the actors had to construct convincing arguments to make sure that they would have a place to sleep that night. They promised to help cook and clean, catch rats and bake pies, offered to sleep in the barn on straw or in the attic on the floor. The actors also had to work hard to understand the locals’ dialect (and vice versa). Reluctantly, the merchants negotiated and then accepted the actors’ proposals, and the scene drew to a close. The actors and merchants reported back to the group about the deals that had been struck.

The next scene had the actors rehearsing the play at the Globe Theatre, working from snippets of the *Romeo and Juliet* script that Heathcote had given out. As they attempted to rehearse, the merchants had been instructed to interrupt the actors with offers of haircuts, cloaks in the latest style, rat fur muffs and apples. The actors/ teachers were becoming nervous because they expected to be performing a Shakespearean play very shortly, with only small chunks of written script and no time to practice. In this state, they had to find ways to politely dismiss the merchants and stop them from interrupting.

Next, actors and merchants found quiet spots around the room to write letters to loved ones. The actors wrote letters home to their families, telling how much they missed them, how hard it was to find a place to

stay and how soon they would premiere their play. The merchants wrote about the strangers who had arrived in town, and about the success of market day.

Then came the opening night of the play – approached with no little trepidation by the actors. We led a processional with music and singing for the opening of the theatre, and settled in a circle around the stage. The theatre manager (one of the children) came out to welcome everyone to the Globe and the debut of Shakespeare’s new play.

Suddenly, the theatre manager fell to the ground. Another child (who had been cued ahead of time to do so) rushed up to lift him up and opened his clenched hand. There was a large black spot, a plague bubo, on the manager’s palm. “It’s the plague!” “He’s got the plague!” Whispers spread through the group. The room went silent. Heathcote’s voice boomed out: “Who will lift this man up and carry him home?” Everyone shrank back, afraid to get too close to the contagious man.

Heathcote asked each person to think for a moment about why they would or wouldn’t carry the ill man home, and then each person around the circle spoke their thoughts. It was a moment of great intensity as local children and visiting teachers confronted their own (or their character’s) fears of the Other, of illness, of contagion. There were echoes of contemporary fears of AIDS and Mad Cow disease, a fear of bringing home a disease that came from a foreign land, suspicions of hosts and guests (“I was staying with the rat-catcher!”; “I wonder what kind of meat was in those pies”). On that note, and after a short debriefing, the drama ended.

Several weeks later, my husband Phil and I led another drama for international English learners. This was a group made up mostly of the spouses of graduate students at our university, who had travelled to England with their partners to support them in their studies. Most of these learners spoke English hesitantly, and had signed up for this free week-long course with the Applied Linguistics cohort to improve their English.

Thinking about the situation of the learners, Phil realized that they would probably feel displaced and ‘not all there’ in England, where they couldn’t understand much of the language, had no jobs or social role, and were far from loved ones and familiar things. In some ways, they must have felt like ‘ghosts’ of themselves in this context. Phil also wanted to address curricular goals of increasing learners’ comfort and fluency in speaking and listening, reading and writing English. Based on these goals and observations, he designed a drama in which we would meet a ghost, learn about that person’s life, ask the ghost questions, send him a private message, and then send the ghost on his way.

In preparation for the drama, we went to the local market and bought a small wooden box and trinkets of all kinds (costume jewelry, packets of old postcards with messages on them, medallions, wallets, buttons, scarves, old photos and so on). These were to be the last effects of the ghost. Phil also prepared the ‘middle page’ of several letters, which started in the middle of a story and ended before the story was done.

Learners were told that we were about to view the last remaining possessions of a person who had passed away, and we tramped past the wooden box as if we were viewing a casket at a funeral. Then learners (reluctantly) picked some items from the box and went back to their groups, where they talked about the items as evidence of the life that our ghost had lived. Each group was very sure about their interpretation – he had loved a woman whose father had disapproved of the relationship – he had run off to join the Foreign Legion – no, he went to Sudan in the war – he was Russian – he was French – and so on. People used the randomly-chosen objects from the box to support their interpretations of the ghost’s life. Finally we came to a consensus about his story.

Next, we lowered the lights and set up chairs in a circle, with one empty seat. That was the ‘hot seat’, where the ghost would sit to answer questions from the group. Whoever wished to could move to the hot seat, from which they would channel the spirit of the ghost and speak in his voice. In a hushed and reverent atmosphere, students would quietly move to the hot seat, and others would ask questions of our ghost. Did he miss his beloved a lot when he went to war? Did they ever see one another again? Did she marry another?

The lights came up again and the learners were instructed to find a quiet spot and write a private letter to the ghost, which would be sealed in his casket of last effects. Again we filed past the casket, and each

person dropped in their folded note to the ghost. The casket was sealed, we performed a ritual poem to send the ghost on his way in peace, and the drama ended. Later on, Phil and I got to read the very moving letters the students had written to the ghost they had come to know and care about.

In both these dramas, students engaged with curricular aims (gaining fluency with speaking, listening, reading and writing English in certain functional modes) in the context of a dramatic experience that brought emotions, ethics and story into play in a way that people cared about. Consider the difference between being assigned a letter-writing exercise in a second language and writing letters in the context of either of these dramas. The decontextualized, assigned letter is a task – a burden – that must be borne. The letter in the drama expresses the learner's innermost thoughts and feelings in their role, feelings of love, homesickness, trust or distrust, fear and so on. Emotion and the context of play change a task to a mode of self-exploration in depth, which also teaches about the human condition.

### **Mathematical Dramas**

Having experienced Whole Group Improvisation for language learning, I was eager to try teaching mathematics in this way. I experimented with two different math drama scenarios, the second of which I have carried out with four different groups over the course of several years.

The first drama, called Earthquake Committee, was a project for a class in my doctoral program in mathematics education. At the time, we were newly arrived in Vancouver, and were very much aware that it was an earthquake-prone area. I gathered books and videotapes about earthquake preparedness, and thought about mathematical ideas that might relate to this topic (for example, logarithms and the Richter scale, trigonometry and estimating the height of trees that might fall over, measurement and logistics related to storing food, water, tents and blankets).

I recruited a group of eight fellow graduate students who came to our residence apartment on a Saturday to participate in the drama. When they arrived, I greeted them as welcome volunteers for the residence's Earthquake Preparedness Committee. They were instructed to sit down around the table and make a name card for themselves, and to be ready to introduce themselves to the rest of the group, stating their reasons for joining this committee. People chose fictitious names, but surprisingly, every person in the group had some real life experience related to seismic events, and there were emotional moments as they introduced their character's reasons for caring about earthquake safety.

The Earthquake Committee drama did not reach the intensity of Heathcote's Shakespeare drama, but there was a strong sense of commitment to action from within the roles of the 'committee members'. I distributed a sheet of questions about earthquake preparedness specific to our residence building, supposedly generated by the residents at a general meeting. Members of the committee formed pairs and set off to learn about these questions. As much as I wished the group to focus on particular mathematical topics (logarithms and trig, for example), I found that I could not necessarily direct the group to a mathematical concept unless it really seemed to matter in terms of earthquake safety – so no one used trig to calculate the height of that tree. Nonetheless there was a great deal of mapping, logistics, estimation and calculation going on, as 'committee members' learned the layout of the building, interviewed the real-life building manager about the numbers of adults and children living there, debated how much water, food and other supplies should be stored for how long and where, and mapped escape routes from different parts of the building. This research and planning was undertaken with a strong sense of passion, since its 'purpose' was such a serious and potentially life-saving one.

The second mathematical drama is one I call Secrets. It was originally devised in collaboration with drama educator Lynn Fels at a time when I was teaching high school mathematics, for a workshop with talented 17-year-old mathematics students at the Shad Valley Summer Camp. I have since carried out a portion of the drama with preservice secondary mathematics teachers in my class at UBC, and I will describe the drama as it played out in that classroom.

When Lynn and I designed the drama, we focused on the dramatic potential of mathematics as secret knowledge. There have been many places and times where mathematical knowledge was a closely-guarded secret with great power – from the Pythagorean secret society, to the high-stakes, cutthroat

mathematical contests of Renaissance Italy involving Cardano, Tartaglia and others, to the mathematicians who deciphered the Enigma code in Bletchley Park during World War II. I had Chilean friends who had been exiled in the 1976 military coup in that country, so I had the idea of setting our drama in a fictionalized version of Chile under military rule.

In preparation for the drama, I needed to create ‘caves’. I had access to two darkened storerooms which could double for caves, but I needed three more. I solved the problem by bringing lots of tablecloths from home and draping the round tables in our classroom with heavy cloth, creating dark, cave-like spaces underneath.

The drama began by having everyone find a spot to perch around the edge of the room. I started with a story of a pleasant, prosperous country in which all the participants were university students in mathematics, computer science and related fields. Then, overnight, the military coup took place. Tanks and soldiers filled the streets, the universities were shut down and people started to disappear.

Everyone in this group had fled the capital for the relative safety of this quiet, somewhat decrepit old seaside tourist town where we all lived now. People had taken up what jobs they could find, and had gotten on with the business of life, working and raising families and keeping their heads down. We went around the room and each person introduced themselves, their work and their situation – ice cream seller, kindergarten teacher, pub owner, fisherman. I lowered the lights, the sun set over the sea, and everyone went to sleep in their houses.

Suddenly, in the middle of the night there was a sharp knock on the door and an urgent whispered voice. These former mathematicians were being called out of bed by the resistance movement. There was a great need for their specialized skills in logic, cryptography, logistics, network theory, computer programming to support the resistance in their work against the military junta. Would they be willing to risk their safety and their families’ well-being to help their country?

Everyone whispered their agreement, and in small groups, the mathematicians were smuggled off to ‘caves’, reminiscent of the caves purportedly used for the secret meetings of the Pythagorean sect. Two groups were shut into darkened storerooms and the others huddle, six at a time, in the stuffy dark caves under the work tables in the classroom. Each cave was lit by a single tea light candle in a jar. Each group was given the stub of a pencil, a small scrap of paper, and a problem of military strategy, supply lines, codes, field hospital triage and so on printed on a slip of paper. They were to work at solving these practical problems for the good of the resistance, and if they completed one problem, there were many others still to go. (I had found these problems in Shasha [14] and adapted the stories to fit our drama of the military coup.)

In the Shad Valley Camp version of the drama, there was a lot more ‘plot’. The mathematicians are discovered and arrested by the military police; a few are singled out, seemingly for punishment but actually to act as informers on their colleagues; there are letters written in code from prison, and so on. In my classroom version of the drama, we had less time, and so ended the drama with the mathematicians being smuggled back home from the caves by light of dawn.

In the debriefing sessions and on feedback forms after the Secrets drama, one surprising comment recurred year after year. I wanted to know how my students felt about trying to solve mathematical problems in hot, cramped, crowded conditions, with inadequate light and not enough pencils and papers to go around – the opposite of the conditions that we usually try to create in our spacious, brightly-lit, well-supplied classrooms. The reaction has always been the same: it was far more exciting to be working on mathematics in the ‘caves’, under adverse and uncomfortable conditions. Students reported that there was a sense of urgency and importance in these circumstances that they had never felt when solving problems in their university math courses. Why? “Because it really *mattered* here.”

This is a very interesting response, because we were all quite aware that it didn’t *really* matter to anyone. We were involved in the drama ‘as if’ it were true – as if there were really a military coup and a resistance movement, and as if we were hiding in caves in the night. The students were all adults, ranging in age from 24 to 50, and all had completed university mathematics degrees. Yet in a matter of minutes, all were able to buy in to the immersive, fictional world we had created collectively, and to feel the

emotions that made their mathematical expertise matter in a felt life-and-death situation. It really mattered that they solved those problems.

Wouldn't it be wonderful to have our mathematics students experience 'math that mattered' more often, math imbued with emotion rather than burden? For that reason, I think that we need to develop further in teaching mathematics with Heathcote's dramatic approach. Of course, one might not teach an entire mathematics course through drama, and some topics lend themselves more to a dramatic treatment than others (particularly those with strong historical connections), but it is possible to bring empathetic, participatory drama to math courses at all levels of schooling.

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