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Queen's University

Alternative Practicum Project

B.Ed. Program

2010

Drama Use in the Science Curriculum

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"Tell me and I may forget. Show me and I will remember. Involve me and I will understand" (Chinese proverb cited in Jansen *et al.* 2002)

Drama is a form of active learning, a way to delve deeper into a subject. This depth gives context, resulting in greater retention and comprehension. This is an understanding only created beyond the use of an overhead and textbook (Hamilton 1992). The grades nine and ten science classrooms are difficult areas to motivate. Some students are excited for the subject matter, while others are simply there because they are mandatory credits. Using drama benefits those more artistically inclined, as well as a number of other intelligences, and works to create a dynamic learning experience. Studies show few teachers integrate drama into their curriculum, either due to fear, a lack of time or a lack of training (Fels 2008). However, all teachers have what is necessary to use drama in their classroom. They only need a little background information and the bravery to try.

To fully appreciate the usefulness of integrating drama into a science curriculum, its influence on students and the classroom needs to be better understood. Research shows that there is a correlation between arts integration and academic achievement, higher-order thinking, literacy and math improvement, student motivation and social growth (Cornett 2007). This is not an exhaustive list of drama's uses in education or student life. The following outlines the benefits of drama integration, followed by a brief outline of dramatic elements. A number of examples are provided for drama use in the grades nine and ten curricula. Hopefully, more teachers will appreciate the importance of arts integration and begin exploring the possibilities of cross-curricular education in science.

Benefits of Drama Use in Education

An attitude towards a situation or object affects the actions taken towards that situation or object. Drama significantly affects the attitudes of students towards the theatre and the arts, as well as their self-attitudes (Rosen and Koziol 1990 cited in Wagner 1998), thereby changing their responses to these two areas. By using teaching strategies such as reader's theatre, role-playing and drama games in the science classroom, students are experiencing a well-rounded curriculum. These cross-curricular moments expose students to new ways of thinking and different approaches to the world. By living the drama themselves, they are able to appreciate the effort, talent, and possibility involved in theatre. If experienced in an encouraging and safe environment, students are able to find this talent and possibility in themselves as they explore different aspects of their personality and situations beyond the day-to-day. A student with a positive self-attitude is more likely to perform well in school (Schunk 1989). The younger this positive perspective takes place the greater the chance for success, hence the increased benefit of including the arts in the "transition years"—grades 7 through 10 (Dweck 2007). This attitude change is a good first step towards social development, as well as academic success through motivation.

Socially, using drama, music and the visual arts in the classroom increases participation, and enhances the quality of this participation. As well, it begins to develop self-discipline in learners (Cronett 2007). This can result in a more interactive and product learning experience. Drama and arts integration supports the development needs of students from the perspective of several theorists. Drama in education fosters social development in support of Vygotsky's theory that shared experience and social interaction are fundamental to cognitive development. Drama necessitates collaboration and interpersonal interaction, thus instigating this type of development. Around the grade nine/ten stage of development, Erikson's stages of psychosocial development suggest students are moving between the "competence" and "fidelity" stages. In the first stage children need affirmation, to know they have worth and are successful. In the second stage, they are questioning their identities and purpose. By using drama, a teacher opens up the opportunity for self-exploration. Students can "try on" different personalities and experiences with the safety of knowing they aren't *true* experiences. These situations of course can be based around a science theme or theory. The flexibility of drama integration is one of its greatest assets as a teaching tool. By creating a positive and safe atmosphere for arts integration, students are able to perform through a creative medium, benefiting a variety of learners—interpersonal, intrapersonal, verbal-linguistic, bodily-kinaesthetic, visual-spatial—and giving them the support and encouragement of self and study they need. Strategic drama use can create a more cohesive classroom, while at the same time teaching introspective analysis. Drama works to develop both internal and external social skills, both valuable to the developing student and the effective classroom. It is the social behaviour of the classroom that teachers look to control during management in order to convey material efficiently.

Teachers are responsible to teach the curriculum by whatever means they feel is appropriate. However, in trying to teach the theory, they end up teaching the student. That is to say, to convey science as a teacher, socio-emotional skills must be taught as a means to maintain order and to encourage the social understanding necessary to grasp some of the more challenging or controversial concepts. Therefore, arts integration is beneficial to the science classroom because of its more subjective angles. Drama and the other arts do happen to be very effective in directing the development needed in classroom management. Drama can expose students to the experience of the other—their needs and emotions—bringing understanding and validity to the need for cooperation and respect. Besides the social education, intrinsic motivation is a means to decrease management needs while increasing student interest. So, if management and motivation are seen as two sides of the same coin (Wiseman and Hunt 2009) then there is great pleasure in discovering that the arts too are shown to increase student motivation (Cornett 2007; Flynn 2007).

Drama naturally appeals to a handful of learners. In such a diverse classroom as the mandatory science classes of grades nine and ten, certain students will be motivated by interest in drama alone. For these students, using drama will create interest in the delivery of the material, thereby making the learning more significant. For many of these students, and for others in the class as well, drama teaches through a variety of learning styles simultaneously.

For example, Gardener's bodily-kinaesthetic learners can be reached by movement and interaction in drama. The interpersonal and intrapersonal intelligences are reached through character/situational development and fulfillment. Verbal-linguistic learners can be motivated through script writing and dialogue, via reader's theatre or plays. Some argue there are artistic, or solely dramatic, learners (Wagner 1998). These students may give up on science education if they are not taught in a manner that makes sense to them, arts/drama integration. By teaching a student at their interest or learning level, motivation is created through enjoyment of learning and through the success that comes with tailored understanding. Dramatic work also creates a strong sense of ownership, quicker than other strategies (Bolton cited in Hamilton 1992). By owning a product, and thereby the knowledge behind it, students engage in the material at a new level. The responsibility for the transformation and assimilation of theory creates motivation. This is exaggerated when students have choice in the product (Lepper and Hodell 1989). Though guided to a degree, dramatic exercises are based around student choice and direction. Drama linked to science often works to create an authentic learning experience; the activity is not valid in itself, but becomes valid through its meaning to the student (Crosscup 1966). Authentic learning experiences also generate motivation through relevance. Learners are better able to internalise these lessons, leading to increased comprehension (Çokadar and Cihan Yilmaz 2010**).** Motivated students are generally successful students.

Many studies show that drama in education increases academic achievement (Flynn 2007). Research concludes that there a significant influence between arts integration and increased test scores (Fiske 1999, Ingram and Riedel 2003, Stronge 2002 in Cornett 2007). If, as Dewey proposes, people learn by doing, then students can engage in any number of situations through drama and learn from them. These situations can transcend school budget, safety issues, social barriers or even natural law. In this way drama helps students better understand abstract scientific concepts that they would usually find challenging (Çokadar and Cihan Yilmaz 2010). Drama allows for the repetition of material through a new delivery method. The theory remains interesting through new context. This engaging repetition increases the likelihood of academic success through retention (Flynn 2007).

Beyond the science expectations, Ontario teachers are interested in preparing students for the Literacy Test. Dramatic learning can increase comprehension, communication skills and reading fluency (Wagner 1998; Cornett 2007). Activities, such as reader's theatre and script writing, help students question audience and themes. While storytelling, for example, helps master language use (Booth 2005). A main component of dramatics is reflection, or debriefing. Literacy can easily be worked into these moments through poignant questions about plot, character, themes and context.

In all pursuits of academic achievement, be it scientific exploration or literacy skills, critical thinking is important for excellence. A number of theorists suggest that imaginative role play is fundamental to the development of thinking (Wagner 1998). Through acting out, one can learn problem solving techniques (Çokadar and Cihan Yilmaz 2010) through the collaborative nature of the activities, as well as the complexity of the situations. The increased comprehension

through dramatics combined with the use of spatial reasoning, conditional reasoning, problem solving and creative thinking (such as elaboration, originality and flexibility) lends itself to the development of higher-order thinking (Cornett 2007). It is these processes that are translatable into science. The ability to reflect, analyse and self-evaluate are all intrinsic to drama. These skills can be adapted for use in the laboratory or scientific problem.

The arts are commonly viewed as a medium for intuitive learning. Drama, visual arts and music are typically considered relevant to the emotional and social areas of education. However, it is often disregarded how fundamental the arts can be in "academic" areas. The use of the arts in these areas is often dismissed because it is assumed the arts lack objectivity, unlike the sciences. They are often regarded as highly subjective, lacking the structure and concreteness of the sciences (Best 1996). However, both areas require logic, rationality, creativity and intuition for success and advancement.

Introduction to Drama

Many teachers do not use drama in their curriculum because of their own fears or misgivings towards the arts based on their own past experiences. But, drama is just like any another situation; it can be frightening or fulfilling, given the context it is used in. Educators should illustrate by example that discomfort can be overcome. This begins with the realisation that they already have the tools necessary to provide a teaching strategy so necessary to learning. Teachers are already actors. They pretend to be angry for management; they pretend to be strong/cheerful when having a rough day. Educators play the judge, the friend and the parent. Everyone, student and teacher alike, is capable of being an actor.

For those with little drama background, some basic understanding is needed to get started:

1. **Common Elements of Drama**

   Elements of drama should be chosen based on where the students are currently. This could vary from week to week and class to class. Drama activities should work to meet students in the moment, with their current social understanding/problems, their interests and needs for expression. For use in science, drama activities may not require the in depth development of all of these elements. To teach a science concept through drama, there is a higher level of predetermination than in a lesson given in drama class. Having a concrete theory or concept in mind limits the potential of the dramatic exploration. This also limits the exploration and expression of the students, but also allows for greater control and management. Some elements are more important for the specific goals trying to be reached.

   a. Character

      Character is the role an individual takes on. A character can be pulled from a story or play, or created from a picture or situation. Characters should be memorable and interesting. Things to think about during

character development include: the age of the individual, education background, cultural background, interests, occupation, religion, family and social relationships, physical appearance, health, dominant mood, and qualities of their personality (McCaslin 1990). These areas are often explored with students, giving them a chance for input. In science, a teacher can angle these discussions to get at the basis for social conflict within controversial science issues, or to understand the character impetus behind scientific change or theory. With time and experience it should become easier to lead these discussions. Room should always be left for student choice and influence.

b. Conflict

Drama can be explored from a "common concern" (Ball 1995) or debatable truth/viewpoint. Conflict can help determine other elements, such as character (Which side of the conflict are you on?) or even setting (Ideally, where would this conflict take place or originate?).

c. Tension

Tension is not the same as conflict. Tension is what drama should be built around. It is a surprising or shocking experience that causes the actors to rethink the direction. It places special demands on the players (to solve a riddle, to act or think in a particular way). Tension is the addition of complications, the change in task difficulty. Students must take on the role of experts to resolve the tension (Booth 2005). This resolution should not be done too fast. The tension should be built so that there is ownership in the solution as students become more involved and interested. One simple way to do this is to slow the action down (slow motion, quiet, creeping, pause to consider, etc.). To reduce the speed, use calm words, describing the situation the actors are experiencing in detail; carefully and slowly narrate the action.

d. Plot

Plot is the journey of a dramatic activity. Whether movement or voice is used, all dramatics tell a story. Plots should be easily understandable with simple dialogue. It is here that the topic of the drama is expanded upon. This is also a great area for student input. The facts and issues should be relevant to students to create motivation and optimal involvement.

e. Setting

Settings add context. For example, investigating climate change in a rainforest tableau (still drama) leads to different ends than in an arctic setting. The perspectives on teaching evolution in schools differ by setting. Setting will change character, context and interactions. A setting should be chosen that is easy to relate to and imagine, even if it is clichéd.

f. Mood

One way to easily change or create mood is by the use of music in the background. A simple way to explore the mood in drama is to base the activity on a picture. Pictures can give ideas about setting, theme or character. Using cues from the picture, like colour, facial expression (if available), lighting, or other visual cues, the mood for an exercise can be effectively established. Leading questions are useful throughout the activity, but are very effective during the settling of mood. Ask questions like "How would you feel if...?", "Why would he/she react this way?", "Think of a time when something similar happened to you. How did you feel?", etc.

2. Common Styles of Drama

The following list is of common styles that can be used in lesson planning. The order they are provided in is a suggested progression, from simplistic and more structured to free and needing more drama experience to be effective.

a. Movement and dance

Movement and dance are the freest of dramatic expression. There are no boundaries on expression. However, it is also the most structured because it is wholly influenced by suggestion. The movement reflects the feeling associated with an experience/stimulus. This type of activity may be the hardest to use in a science setting to explore a concrete notion. However, it can be effective leading into or out of another dramatic experience.

b. Pantomime

Pantomime is the creation of a picture, or series of pictures, with bodies. It is very controlled and structured, while allowing for a small degree of freedom for the students. Students become elements in a scene. This can be based on a setting, a mood, a theory, etc. This is a highly cooperative experience, as the actors must work together to create a unity in the product. It can be spontaneous or planned out. For example, a general idea of what is to be explored can be given. One by one the group, or entire class, becomes new elements of the whole. In the creation of a laboratory, the first student may become a human lab bench, the second a scientist working at the bench, the third a beaker, etc. Students will take the ideas of others and build on it. This is usually intuitively understood, but may take a little guidance in early experiences. In a planned out scenario, students are given direction and break off into smaller groups. They have time to plan out their pantomime(s) before performance. In a series of pantomimes, a cue can be given to switch, there can be movement to a new location in the classroom between poses, and the

actors may even need to come up with their own timing and transition, possibly set to music. The combinations for use in pantomime are nearly endless. There is always an interesting variation.

c. Miming

In miming, the element of movement is added without adding in the element of sound. There a few solid miming techniques that students can learn (like how to "touch" something solid), but in the science classroom this depth of drama knowledge is not relevant. Miming can happen individually, in small groups or the entire class. It is easy to transition between these levels, as the teacher will be easily heard and followed. For example, a student can explore creating their own imaginary experiment through miming, and then can be lead to interacting with other "scientists" around them, showing off their experiment and handling other's experiments.

d. Reader's Theatre

In reader's theatre, there is a script that is read, a voice element, but no movement. Students can determine placement and spacing, use gestures and intonation to effectively read a script. Scripts are often based around curriculum content, and can be adapted from almost any play, book or story. The scripts are often short, 2 pages, and include cues for expression or sound effect. As a script is dramatized, the audience can get involved by also following these cues. Script can be easily written to suit classroom needs. Remember to include interesting and simple dialogue and blocking cues (emotion, sound effects, stage location, etc.). Scripts can be adapted from picture books, fairy tales, poems, short stories, biographies, etc. Students can also practice writing their own scripts, by providing them with clear guidelines on what needs to be included (length, topic, number of main ideas/quotes, etc.). Reader's theatre is an easy way to include literacy skills. Student can work to identify key points, the audience, a theme or topic, and any number of literary elements.

e. Storytelling

Educators tell stories to give context and depth to theory. In storytelling, students create a story based on specific guidelines to elaborate on a concept, almost like acting out a storybook or fable. Voice and movement are a part of this activity; however, they are often limited by the dominance of a narrator. The teacher or one student becomes the narrator of the story, explaining and directing the action of others fulfilling the story. This can be planned before performance, by the teacher or student, or can be spontaneous, completely driven by teacher guidance. In the

second option, suggestive questioning is an excellent way to include individuality.

f. Simulations

In simulations, students become parts of a working whole. These activities, compared to other styles, are more concretely tied to science concepts. For example, students become parts of the digestive system. The teacher can then manipulate the entire system or individual parts to provoke a consequence. These activities are often highly directed by the teacher. It is the small nuances of the scenario that show student intuition (like the shape, movement and noise the student stomach makes, or deciding what can go wrong with the intestines). Scientific theory can be pulled out to direct the simulation (ex. Students are asked to explain what part of digestion occurs in the small intestine. The actor can then create a representation of villi, add a sound effect or motion, etc.). There is little to no student preparation for this type of drama.

g. Role play

Science becomes role play when learners are directed to behave in contradiction to reality. The difference from reality may be temporal, geographic, social, corporeal, or dimensional in nature. Two common strategies are to take on social situations they have never experienced (ex. Take on personalities in controversial debates, consensus conferences, historical moments, etc.) or to role play abstract physical phenomena, otherwise unobservable in the classroom. The first works well to convey the impact of science and technology on society, engaging in the empathetic understanding surrounding issues and concepts. The second works to create 3-dimensional models of processes and a controllable reality allowing for the exploration of dangerous, complex or expensive situations. Role play can be used in conjunction with other dramatic styles. Imagination and pretending are the keys to making this work. Students may have trouble with this. They may need to be coached into accepting their own imagination and supported, by the teacher and peers, in expressing it. It is important that participation is not forced, but positively encouraged.

h. Improvisation

This is the least directed and most complex of all the dramatic styles. In general, “the use of improvisation exercises with children, except very casually, is not particularly necessary or desirable” (Crosscup 1966). To teachers with limited drama experience improvisation can quickly get out of control and lose sight of the learning objective. If used correctly, improvisation can be very effective at creating energy and releasing

ingenuity, which may be very important in the science classroom. Improvisation starts with a proposed idea. A scene is set very quickly by the teacher and students are left to complete the scene filling in any missing information as they go. One issue common to improvisation is the surfacing of prejudice in the roles. It is suggested that if this occurs, it is best to ignore it at the time and address it after the conclusion of the activity (Heathcote 1991). By shutting down the exercise at the time, students may feel a lack of acceptance in their drama and fear taking risks in the future. In all dramatic activities, one should push towards the teaching ends without destroying the contributions made (Heathcote 1991). There are many variations on improvisation activities that can be explored, making it a very useful tool. However, it should be used sparingly in the science classroom and only under clear theoretical goals.

Using Drama in Curriculum

With the basics of drama established, planning and implementation in the classroom needs to be explored. To decide when it is most effective to use drama takes time and practice. It is usually determined by the needs of the classroom. Much of drama in education, whether before, during or after the activity, is about management. A class that needs focus and structure at given period in time may need very selective drama use with a lot of control, or no drama at all. A class that does not work well together may benefit from a highly interactive and collaborative drama experience with high amounts of resolved tension, especially when directed to work as a whole. Choosing to use drama, the style of drama and the subject in drama should be based are meeting learners where they are in time and life. In planning, careful decisions must be made about the dramatic situation (what is being acted) and the dramatic actions (how it will be acted) (Courtney 1980).

Content should be clearly identifiable and relevant to curriculum expectations. The subject matter should be what the students have genuinely experienced, whether personally or vicariously. Even the use of role play should be grounded in what they already know. A wide range of resources should be explored and collected. Dramatic situations should be well-rounded and creative. Pictures are an excellent way to begin developing drama, but should be carefully selected for effectiveness. They can be used to create setting, character, mood or context. The use of music during dramatics can also be effective in creating mood and adding context. It should be evident what expectations are easy to convey with drama. That is not to say that more complex or abstract theory cannot be taught through the dramatic arts. With time and confidence, incorporating dramatics throughout the whole science curriculum is attainable.

Dramatic action should involve the entire class. Every student should have the option of participating fully in the drama and every student should learn to be an active audience. When picking a dramatic style briefly research, so as to provide enough information for solid understanding of outcomes and participation needs. It should be decided beforehand, and made

clear to students, what limits are in place regarding time, space and touching (Heller 1995). To decide what style bests works for a given topic, think about how much control is needed to deliver the amount and type of information desired. Consider also the amount of space available and how knowledgeable and comfortable the students are with drama/acting. Begin drama use early with the class. Scaffold the artistic, social and reflective skills to eventually teach through more demanding forms of drama. In the beginning, it may be easiest to explore lesson plans and activities created by others to gauge the appropriateness of content to style.

A simple way to prevent management needs during these lessons is in the lesson sequence. A typical drama lesson has a flow in energy that helps to focus and transition students effectively. Usually, the class begins with a warm-up activity. These are often simple activities that engage the muscles, voice and memory. The point of the warm-up is to bring the students into the drama head-space and transition *in* to the class. Next is a control exercise, which is often quiet and reflective in nature. The main dramatic activity comes afterward. This is the main purpose of the lesson, the storytelling, role playing, etc., that conveys a certain topic or idea. *Every major drama activity should be followed by a debriefing* (Fels 2008). It provides finality to the activity and allows for a collaborative chance to touch on any material that was not explicit or included. Extensions can be made during this time and students can critique themselves and each other. The debriefing is also a good place to include literacy. It can take the form of a discussion, worksheet or report. The last stage is relaxation, a quiet activity to transition *out* of the class. The extent of drama use in a science lesson is up to the discretion of the teacher. But as an example, the class could begin by miming individually that they are astronauts preparing to board a spaceship. They then could transition into a control activity of imaging the countdown, what they are feeling, the read out on the gauges and the force are the engines propel them out of the atmosphere. Perhaps, the class transitions into a reader's theatre activity about visiting an unknown planet. In this activity they learn about differences in gravity, atmosphere and sustaining life. They then answer a few questions about the play to be handed in. With the few minutes remaining in class, they discuss in pairs what it would feel like to return home after months of being on the space station.

Other areas for management include choices about rules, signalling, classroom arrangement and grouping. Rules about touching, encouragement and cooperation should be in effect before beginning drama use. Drama can help encourage peer support, but only if the ground work has been done. Signals should be known to students. A clear signal should be in place to pause the drama for audience or teacher input. There should also be a way to signal transitions, whether between activities or within an activity. As with other classroom activities, the teacher needs to be mindful of student moods, interactions and needs, while providing clear instruction and support.

Other than managing the class during these exercises, teachers need to work to keep progress going in the activity and to ensure it reaches the desired learning outcome(s). It is up the teacher to lead rather than instruct. This role opens up new risks to the teacher and can be uncomfortable at first (Courtney 1980). From outside the drama, the teacher can ask leading

questions to influence the drama. These questions can be used to: draw out information from the students, seek out their interests, prompt the need for research, establish a mood or feeling or encourage reflection (Booth 2005). It is important not to diminish the work already done, as a way to support the group and individual. The teacher can also make suggestions of volume (or silence), pacing, energy level and movement (or stillness) as is needed for context, mood or emphasis. The leader can pause the action to ask questions and add explanations, or to go in a different direction to explore another side of the topic. It is also an option to completely restart an activity, changing players and roles, or other characteristics of the drama.

In contrast to being an outside influence, there can also be the teacher-in-role. In this case, a teacher takes on a related role in the drama as needed, usually in the beginning of the work. This is effective to bring a group together, as the authority is now within the group (Wagner 1999). It can also work to help more timid or sceptical students, by showing the teacher is able to be imaginative and dramatic. The role taken on should not be a central role, but something more peripheral, like an "outside visitor".

At the end of a drama-based lesson, or for a product performance, the assessment should be of the drama *in science*, which is different from assessing drama itself. The focus is on the communication of the science content, and the manipulation and application of that content. The drama can play a subset in skill evaluation. In this area one could evaluate the students awareness of style/genre, their use of shape, appropriate use of resources, group work skills, reflection on self and stages, etc. (Rubright 1996). This would depend on what the individual teacher decides is important for the student to take away from the exercise. By involving students in the evaluation process, they can learn self-analysis and reflection, skills which are translatable into science.

Examples for Use in Grades Nine and Ten Classes

The following are examples of drama activities related to specific curriculum expectations in the Ontario grades nine and ten science curricula. It is organized by style (the same progression as presented earlier). Some activities briefly outline adaptations for similar use in other nine/ten units. The expectations provided are based on the overall expectations, and are therefore easily relatable to both applied and academic streams. The descriptions are simplistic to allow for individual freedom and easy adaptation.

1. Movement and dance (and ritual)

Grade 10: Chemistry	Expectations: C2/C3
Activity: Every student is assigned an element and its charge as an ion (hand out name tags with information on it). They move around to music. When the music stops they must join with other students to make a balanced molecule. Repeat. - All students with the same element (or of similar charge) can work as a group to come up with a game plan, as well as a signature motion and sound to use during movement	

Variations/Extensions:	Adaptations:
- Students are assigned an element and must find out what their charge is. Switch elements every few rounds. - At the stop of music, only form (i) ionic bonds or (ii) covalent bonds	Grade 9: Chemistry - As extension - Can have them move/sound to display charge. When music stops similarly charged ions group together

Grade 10: Biology	Expectations: B1, B3
Activity: After learning about a system or illness, students work in small groups to come up with a ritual healing. The ritual should demonstrate their knowledge of the affected area and the illness present, possibly with symbolism for known treatments. The ritual can be completed with movement and brief sound effects. There should be no talking. The duration of the ritual can be based either on time or the number of movements. This activity can be introduced after a brief reading or activity about natural medicines, healing ceremonies, etc.	
Variations/Extensions: - The ritual can start from the system and move into the cell. Students should know/research some special functions of the organs, specific, organ, tissues and cells affected to incorporate into the ritual - A burial ritual. Outline the symptoms of a fatal condition and how they manifest in an individual. The ritual can incorporate these facts. It should be guided from remorse to a celebration of a life well lived	Adaptations:

Grade 9: Biology	Expectations: B2
Activity: Sound-scape of change As a class, students each create and continue a noise related to a certain environment. One after the other students add to the sound tableau with new noises that could be found in that place. Ex. A forest: Swishing of tree leaves, the wind, crickets, birds, the sounds of animals digging or foraging, a river nearby, a quiet hum or tune to add mood, etc. After everyone has added to the sound-scape, a few students are chosen to make noises of change to the area. This change can be predetermined through brainstorming or can be spontaneous. Ex. Change to a forest: a chainsaw, a hammer/sounds of building, footsteps, talking, etc.	
Variations/Extensions: - Consider both positive and negative	Adaptations: Grade 10: Earth and Space

changes. Discuss which is more obvious in the sound-scape. Is this true to life? - To symbolize the loss of nature, continue to add a succession of "man-made" noises. Then, have a signal to make the natural noises start to die out one by one.	- Relate to climate change and impact of human activity of ecosystems

2. Pantomime

Grade 9: Biology	Expectations: B3
Activity: Ecosystem Tableau One by one students become part of a pre-decided ecosystem (decided as group or by teacher). You can play a guessing game with them to draw out understanding. (Ex. Oh wow, let me figure out what you are. Are you abiotic? Do you move? Do you need lots of sunlight to grow? Etc.) While holding the tableau, outline a change (due to human influence) and the repercussions (ex. "Everyone who is a tree you are now cut down" or "Small plants become large trees after succession"). Have the students analyse the effects of the changes through time. They can slow-motion through time to narrative cues if desired. (Ex. "In a few years after the water has been polluted half the plant life dies". –Change and hold- "Herbivores and omnivores struggle to find food. Their numbers dwindle." –Change and hold- "Carnivores now struggle to find food." –Change and hold- "Humans realise the problem and begin bioremediation", etc.)	
Variations/Extensions: - Get a small group of students to be human. While the large group is holding the scene they can come and physically change it. Have them explain the changes they make and explore the effects	Adaptations: Grade 10: Earth and Space - Relate to climate change and impact of human activity on ecosystems Grade 9: Earth and Space - Use ecosystem understanding to explore the possibility of life on other planets. Ex. Become an alien planet (outline qualities – direct student roles) and change the tableau by discovering what is needed to make life

3. Miming

All grade 9/10 units	Expectations: N/A
Activity: Charades	

- Can be applied to any unit - Words or phrases can be predetermined, spontaneously generated by the teacher, or brainstormed into a word bank by students based on concepts and vocabulary in unit - Can play in teams or as individuals	
Variations/Extensions: - Act out in pairs or small groups for complex theories - Use as a diagnostic – simple unit terms, previous learning	Adaptations:

Grade 9: Physics	Expectations: E1
Activity: Make a machine Students "build" a machine through their miming that fulfills a particular role of their choice. They then decide how it will be powered (thinking about how much energy they'll need and where this comes from, what to do with wastes from this energy, collect from the source, etc.) and hook up the machine to the power source. They interact with their own machine; powering it and enjoying it work. Students are then lead to interact with others and their machines. By miming, they can "explain" what their machine is, how it works, what it does, and how it's powered. Debrief by exploring the different purposes of the machines. Relate this to everyday power uses. Explore the different ways people powered their machines (real or imaginary).	
Variations/Extensions:	Adaptations: Grade 9/10: Chemistry - Students can imagine they have created a new molecule or discovered a new atom. They can explore the properties and then interact with others. A few can be mime presenters at a symposium.

4. Reader's Theatre

   Flynn's book, *Dramatizing the content with curriculum-based reader's theatre, grades 6-12* (2007), is an excellent resource for using reader's theatre. This book outlines what reader's theatre is about, and to find scripts or adapt different resources. It provides examples of planning sheets (p. 46), script templates (Appendix B) and assessment tools (p. 49). Appendix A offers several samples of curriculum-based scripts, for example, "Energy" and "Halley's Comet".

Grade 9: Biology	Expectations: B1, B2, B3
Activity: Read Dr. Seuss's "The Lorax" to students. In small groups, have them write a reader's theatre script based on The Lorax story, or	

around a theme from The Lorax	
Variations/Extensions: - Students can research an area currently experiencing environmental problems to write their script about – direct based on themes from the book	Adaptations: - Write a script in Dr. Seuss style to suit any unit - Write a script to work with any unit expectations

5. Storytelling

Grade 9: Chemistry	Expectations: C3
Activity: A journey through time: The discovery of the atomic structure Turn the history of atomic theory into a story. Small groups act out the different experiments and take on the roles of the scientists (Ex. Thomson, Rutherford, Bohr, etc)	
Variation/Extensions: - A small group can "be" an atom while the others role play the history. They can change the shape of the atom based on the understanding of atomic structure at the time of role play (ex. Plum pudding model, Bohr-Rutherford, etc.)	Adaptations: - This can be adapted to suit any history or theory development in any of the 9/10 units

Grade 9: Earth and Space	Expectations: D1/D2/D3
Activity: Mars: A Movie (Kapileshwarker 2009) The assignment: "You have been asked to prepare an international blockbuster science fiction movie about life on the planet Mars. In order to make sure the movie is as realistic and believable as possible, you and your producing team have extensive research to conduct about Mars. Your research will include viable methods of transportation to Mars, composition of Martian soil, possibility of alien life forms, evidence of water and its implications/uses, and general ways of successful life for human settlers." The assignment can be completed as a manuscript, as a screenplay, a movie poster or documentary.	
Variations/Extensions: - Compile group work into one main script for class and perform/record - Take on the role of a film critic to write an article about the film, placing emphasis on stating the key ideas	Adaptations: - The creation of a film (and its related products) can be used in all the grade nine and ten units

6. Simulations

Grade 9: Physics	Expectations: E2, E3

Activity:
The Human Circuit
In this simulation students become atoms in a wire. Each is given a crumpled piece of paper (a bouncy ball, block of wood, tennis ball, etc.) that represents an electron.
Use students' prior knowledge, as well as meaningful questions, to create and enhance a circuit. For example, before the electrons can be passed, one student needs to become a battery or generator. Nametags can be used to identify different parts of the circuit.
This simulation can end in any number of places:

- Consumer/Load (students can choose what action/noise/facial expression the consumer will do when provided energy)
- Adding the concept of electromagnetic energy (ex. a tunnel from generator/battery to consumer)
- Parallel vs. series circuits
- Switch (student can become a switch directing electron flow)
- Conduction (change what kind of atoms they are)
- Resistance, etc, etc.

Variations/Extensions:	Adaptations:
- Relate to circuit diagrams, use symbols from circuit diagrams to label actors	Grade 10: Physics - The Human Ray Diagram Grade 9: Earth and Space - The Human Solar System

Grade 10: Biology	Expectations: B3

Activity:
Body Systems
(Taken from Wade 2007)
One student becomes the lungs and is given red balloons. On the other side of the room, a student becomes the body and is given blue balloons. In between them a student becomes the heart. The rest of the class are red blood cells. The red blood cells start one by one at the lungs to collect a red balloon, they are now oxygenated blood. They cross at the heart to give up their red balloon at the body for a blue balloon, carbon dioxide. Student continue to make a circuit giving up red balloon for blue balloons at the body, to return back through the heart to give the blue balloon up for red at the lungs again.

Variations/Extensions:	Adaptations:
- See Wade 2007 for further use – digestive system with circulatory - Complicate things by giving up red for blue at the heart too (coronary system) - Create systems for different animals (fish, birds, etc.)	

Grade 10: Chemistry	Expectations: C2

Activity:
Types of Reactions
Students are given different coloured stickers or name tags (one of four different colours).

Work through the four different types of reactions: Synthesis – student of two different colour cling together Decomposition – students clinging together let go Single displacement – Student clinging together switch one partner Double displacement – Two couple clinging together switch partners	
Variations/Extensions: - Each colour can be a specific element that works to create a known compound in these reactions – this knowledge can lead to dramatic action based on compound/element characteristics - Can use to investigate more complicated equations, again using drama to convey characteristics	Adaptations:

7. Role playing

All Grade 9/10 Units	Expectations: N/A
Activity: Controversial Debates Based on a controversial topic, students are to argue both sides of the issue. In preparation, they should briefly research the topic from both sides. Group students on both sides of the argument. This can be revealed beforehand, for focused preparation, but revealing it at the time of the debate forces a well-rounded knowledge. Students have time to confer with their group to briefly outline an opening statement and a series of general arguments. Both sides then present their opening statements. Here a directed question can be posed to one side. Choose which side based on chance, so there is no argument over fairness. The question should direct the debate to a desired learning outcome. The students answer the posed question. (In all cases time can be given to prepare a rebuttal or answer, or can be prompted on the spot depending on the class and situation. For this example we will leave this adaptation out). The opposition rebuttals. This can go back and forth a long as desired, or can be limited to one rebuttal and one return. In the latter case, a series of questions should be ready to be asked, alternating from one side to the other. The debate ends with closing statements These dramatic situations should <u>always be debriefed</u> and controlled for time and appropriate behaviour. Students should be encouraged to *become* the argument they portray (ex. Costumes, accents, character development). Their stance can be personified in a group of people (Ex. Lobbyists).	

Variations/Extensions:	Adaptations:
- There are many different types of debates that can be researched and used. Some are more controlled that others - The debate can involve the entire class, or there can be a series of small debates on similar subjects by smaller groups.	

All Grade 9/10 Units	Expectations: N/A
Activity: The News Report Students can work in pairs or small groups to create a news broadcast centered on a topic in science. For relevance relate it to new discoveries, research, etc. Look through journals, science magazines and science teacher websites (such as STAO) for up to date information and interesting topics. The product can be in the form of a teleprompt write up or presented as the broadcast.	
Variations/Extensions: - Create a radio show - Create a podcast	Adaptations:

8. Improvisation

All Grade 9/10 Units	Expectations: N/A
Activity: The Hotseat A student is chosen to be in "the hotseat". They are given an identity and asked questions by the class. There should be minimal amounts of pressure on the actor. Questions should be directed to character answers and theoretical answers. There are endless characters to play. It all depends on the needs presented in the lesson and by the students. Characters can be spontaneous, planned or researched. A student can take on what they assume a type of person to be (Ex. An inventor). They can also follow a fictitious profile created by the teacher. Or, they can base their improvisation around a real person.	
Variations/Extensions: - Follow an in-character presentation (Ex. Pretending to be Neil Armstrong to communicate knowledge about the moon) by a hotseat - Teacher-in-Hotseat: the instructor takes on another persona and teaches/answers student questions	Adaptations:

as this character - The Panel: a small group of students sits as a panel for questioning	

Grade 10: Physics	Expectations: E1/E2/E3
Activity: The Trial of a Light Wave (Smith 2006) In this activity, a light wave is on trial. Evidence is produced in the form of experiments, readings, lectures, simulations, etc. These can be introduced during the trial, or can be drawn out from previous lessons. The article outlines the trial, giving ideas and prompts.	
Variations/Extensions:	Adaptations:

Drama in education works to motivate students by creating interest and appealing to a variety of learners. In the science curricula, drama provides a new means for teaching investigative and reflective skills. It can allow for the exploration of abstract theories or concepts/situations that are too dangerous or expensive for the classroom. Using the arts does not have to be complicated. There are a number of easy ways to bring drama into science. Patience is needed when beginning to implement dramatics. Allow for time to scaffold, learn about personal thresholds, and the compilation of resources from a variety of mediums.

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