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Seeing and Learning Astronomy and Cosmology Through the Lens of Music

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Introduction

As a musician, I have often thought how greatful I am for the contributions of science and math to the field of music. Without the contributions of math in our Western culture, the study of music or science might not have taken root. The very shape and form of our western scales and modes came from the Greeks and their interest in and observation of the mono chord. The scientific method that evolved from the study and observations of string lenghts has shaped the very sound of the music that all of us listen to today. The same scientific method that shaped those sounds that we now call music, also lead the Greeks to learn and understand the workings of the heavens; the birth of “spherics” (astronomy).

Students discovering facts through their own scientific projects , such as (through the construction of a mono chord in class); first, that the sound caused by the string depends on the length of the string;or second, that harmonious sounds are given off by strings whose lengths are to each other as ratios of whole numbers, becomes the timeless lesson of discovery.

All of this is made dramaticllay possible through this kind of interdisciplinary approach. After such a lesson, hopefully students will have a better understanding of how math, music, history, and science can be learned together in a single activity, and how each discipline is related to a single concept presented in the class room.

Through the study of modern astronomy,cosmology and music, there are many connections that can be made with the study and observation of sound and light waves in the class room.

The central theme or subject that runs through and connects all the disciplines presented in the development of this unit is the study of waves.The lens of music refered to in this curriculum unit is the understanding of the nature of waves and all of it’s many forms.

The questions and conclusions that human beings have made about the nature and workings of the Universe that date from the dawn of civilization to present times are constanly being put to the test by tomorrow’s discoveries and observations done with the help of the study and interpreratation of waves.

Another example of this concept of the study of waves is by students understanding of how radio waves travel

though space. They gain an understanding of how radio signals trasmit the sounds of music that we like, yet those same waves also help us to unravel the secrets of the universe and cosmos far away in deep space. This type of study of waves might also be an introduction to how MIDI instruments work.

The “interdisciplinary approach” of this unit lends itself to the adaptation for all grades and needs. While this particular unit is designed primarily for High School students, I would encourage teachers of all grade levels to explore ways that this material can be adapted to for their classroom in the following pages.

I have attempted to address the needs of different grade levels as most music teachers work with a variety of levels within a particular school setting. For example, a music teacher assigned to an elementary school might work with kindergarten through fifth grade. There might also be a class or two of students with special needs.

I have taught in the New Haven School system as a permanent substitute and I loved it. As a permanent Sub, I was given extra responsibilities such as bus duty, the extended day program, and the Metropolitan Opera, “Create Your Own Opera Program” at Strong School. I have also been a substitute music teacher at both Nathan Hale Elementary School and at Katharine Brennan. I am currently teaching part-time at the New Haven Cooperative High School of the Performing Arts, teaching strings: violin, guitar, and electric bass.I have been Viola soloist with the Hamden Syphony Orchtrestra. I am a member of the 92 Street “Y” Chamber Music Society. I also have been asked to become involved with the Urban, Suburban Fellowship Orchestra, which features the teaching of improvisation to string players and encourages them to present whatever special skill(s) they have to their peers as well as assisting them to develop basic musicianship skills, such as sightreading, music theory, etc. I also teach at Neighborhood Music School both in the Fair Haven and Hill Branch.

This Seminar would be part two of the first curriculum unit

“Teaching Academic Skills Through the Exploration of Music” .

The seminar “Outstanding Problems in Contemporary Astrononmy and Cosmology” has provided me with exposure to new and updated issues facing our scientists and musicians of today and tomorrow with ways of integrating contemporary developments in astronomy and cosmology which in turn support the development of academic skills by assisting students to think and learn in new and creative ways.

This Curriculum Unit is Primarily for High School Grade Levels

While teaching music, I have encountered many students that have asked, why are there 12 different key signatures as opposed to 47? Why are there major and minor scales ? Why are “they” called major and minor scales? What is the difference between a scale and a mode ? Why are intervals between pitches spaced the way that they are ? Why are pitches the same letter at the octave and not at the fifth ? Within the traditional scope of music teaching methods, the questions above might not be addressed at all. Natural occurances of curiosity are a gift that can be encouraged with an interdisciplinary approach.

I must say that,when setting the stage for new ways of exploring Music, Astronomy and Cosmology, it is a lot of fun to see the expression on students faces when they learn the historical roots of Pythagorean astronomy, which thought that bodies moving through space produced sounds and were all harmonized, ‘music of the spheres’.

I might start with how present day scientists would roar at the conclusions made by the Pythagoreans, who in particular contributed so profoundly to the development of Western science and music. In the 16th Century ,

the revival of Greek culture, paved the way for Copernicus, Kepler, Galileo and Newton to develop the laws of planetary motion.

Students might also have fun learning about the many composers in history who used the stars or planets as the main theme or concept behind their musical works. The list of composers might include: Mozart's "Jupiter" symphony, or Holst's "The Planets".

I would like to transfer information presented in the seminar "Outstanding Problems in Contemporary Astronomy and Cosmology" because it is a way to utilize the study of science and mathematics in conjunction with my music classes, thus enabling me to enhance the understanding as well as the importance and history of " the interdisciplinary environment" for my students.

Just as the revival of Greek culture brought about important scientific discoveries in the 1500's and 1600's, so has recent exploration of Kepler's Astronomical Data from Harmonices Mundi 1619, (realized on tape with theorized sounds of the spheres within range of the human ear created by Yale Professors Willie Ruff and John Rodgers) brought to light profound connections for the scientist and musician alike.

The following quotation is taken from their article in *American Scientist, May-June 1979* , "Kepler's three basic laws of planetary motion. . . .could perhaps not have been discovered without serious backing in music theory " (Hindemith 1952).

The teaching of music in combination with Astronomy and Cosmology has been carried on throughout history. It is my hope to bring these disciplines together again through students' participation in our present day modern classroom.

Teaching music through an "interdisciplinary approach" can affect students positively in the acquisition of academic skills. After a full year of using my first curriculum unit developed within the Teachers Institute, I am still of the opinion that the way in which we experience music, language, and learning has changed due to the advent of interactive technology (i.e. CD-ROM's,Virtual reality generators currently being developed by cable networks,telephone companies,internet networks) and the coming of age of interdisciplinary arts presentation. Rarely is any academic subject presented in the class room per se with out the use of some form of media aid, presentation or demonstration lab experiment.

As a result, how students perceive,experience, and respond to learning subjects such as reading, writing, math, science, and understanding art or music has appeared to have changed over the past fifteen to twenty years.

For teachers, this "change" might not be viewed as positive. It is the goal of this teaching unit to provide teachers with an effective way of organizing resources that build reading, writing, and comprehension skills while providing students with exposure to art, music and a scientific prospective. In order to do this, I shall use the study of sound waves, as it lends itself easily to the combination and study of three disciplines.

The study of music,math, and science together might spark the imagination of the students in ways that just the study of each subject in isolation with class discussion alone might not. The analysis and critical thinking skills are also developed with this type of unit.

While students imaginations might be sparked, and their world view expanded, other skills such as the ability to read with comprehension, to think, analyze, and process information critically and express ones personal

view and discoveries in writing might go undeveloped. These skills can develop only through consistent work. Without motivation, students will not have the heart or desire to put in the hard work necessary to develop and treasure strong traditional academic skills.

Unit Strategies:

The approach used in this unit is based on A.N. Whitehead's writings on "Aims of Education". Each section or lesson unit shall have three main parts. That is, 1. Romance, 2. Precision, and 3. Generalization.

The "Romance" section is that part of the unit that hopefully provides the development of each student's interest, motivation and inspiration to participate in study of each concept presented.

Another way of presenting this part of each unit might be characterized as the fun or clever part. Educational appetizers if you will. If the student's interests survive this segment of the strategy, then they will naturally want to gain or acquire the skill to delve more deeply into the use of the actual tool, skill, or concept presented in this section.

The "Precision" section is where the student gets hands on experience with tools, concepts, or skills to understand more fully the inspirational segment of the unit. [1]

The final segment is the "Generalization" section. This is where the skills, concepts, or tools learned are applied in extending creativly the process of learning begun in the "Romance" stage.

If all three sections are organized correctly, the Generalization section will lead into the next level of "Romance". This will in turn lead the student to want to gain more skill or precision and so on.

Example

Lesson Plan One:

An example of this process might be as follows:

1. Romance Section

The "Romance" section might be to have a student or group of students presented with the oportunity to look at just the stars, planets, galaxies trhough a telescope.

2. Precision Section

After seeing the night sky through the telescope, students might be motivated to learn such "Precision" skills as , how to locate stars by celstial coordinates, how the telescope magnifies, or how to read a star atlas to identifiy constellations.

3. Generalization Section

The "Generalization" section might include the opportunity to work with different types of telescopes. Students might also be lead to study related fields,such as Astrophyics, Radio Astrononmy, Astromonical Photography, and so forth.

Suggestions for Teachers

Academic skills learned through this type of curriculum unit will depend on the background, the defined need

area(s) of the students, the grade, level and the types of teaching styles and experience of the teacher using this procedure.

The desired outcome from the students taught by each teacher who uses this unit is also as diverse as the approach presented. Some of the defined academic skill areas are as follows:

1. Vocabulary lists:
help to map, draw out, define, indentify, or clarify the context of an abstract idea or concept presented in more than one discipline. For example, the concept of the theme used in “Star Wars” can be presented by using the introduction of the film. This sugestion might make a good “Romance “ segment of your vocabulary list.

2. Exposure to science:
the use of a journal is a way to encourage students to participate in the development of their powers of observation. With the use of a journal, the teacher can demonstrate the benefits of observation not only in science, which, of course, is the first step to scientific thinking, but can show how that same skill applies to art and music as well.

Scientific relationships such as in the film “Jurassic Park” can take the rather arcane point of view of a paleontologist and bring it into the realm of filmgoer. Film can dramatically present the wonder of the great scientific minds and why their contributions are so great.

The study of sound waves in this film is a point of departure for music as well. Sound waves are used to observe and find dinosaurs in this film. The graphing of sound waves or the use of sonar demonstrates the mathematical form of observation, or using math to view or study that which is normally not visible to our world. Musical notation is also a form of graphing, observation of, or recording of sound waves. The choice of how their powers of observation are used, whether for science, music, literature, or art is theirs.

3. Documentation Skills:

a. The teacher might set up each lesson plan in a way that both observation and listening skills grow with good documentation skills at the end of each lesson.
b. Each student might be given a booklet that has a section for each area covered:
I OBSERVATIONS, OR { THINGS THAT I SAW IN TODAY’S LESSON}
II LISTENING SKILLS, OR {THINGS THAT I HEARD IN TODAY’S LESSON}
III HISTORICAL FACTS, OR { WHAT I LEARNED ABOUT THE HISTORY OF ___}
IV MUSICAL FACTS, OR {WHAT I LEARNED ABOUT MUSIC IN TODAY’S LESSON}
V VOCABULARY WORDS, { NEW WORDS THAT I LEARNED IN TODAYS LESSON }
VI SCIENTIFIC FACTS, {WHAT I HAVE LEARNED ABOUT MATH, NUMBERS, SCIENTIFIC METHOD, WEATHER, ENVIRONMENT}

At the beginning of the unit the teacher might tell the students which section to write in.

Toward the middle of teaching the unit your students should begin to select the section to write in independently.

Each lesson should have a central theme or concept to be entered and documented in different areas at the end of the lesson. (The teacher might want to start off with each discipline as a single subject and gradually integrate the disciplines as they approach the end of their unit, as the needs of the students might dictate).

4. Developmental Skills:
this area of learning is one that can not be addressed directly, yet is of utmost importance in terms of the acquisition of academic skills. If a central concept of waves is presented through the lens of differing disciplines, cognitive, listening, memory and analytic, gross and fine motor skills are stimulated.

Since virtual reality machines are at present new, awkward, and very expensive for most classrooms to employ practically in the classroom, film clips are the next best thing. The more senses that are involved, the more learning has the chance to take place in the classroom as a whole.

Given that each person learns in different ways, the multiplicity of a interdisciplinary approach supports a wide range of levels, styles, and types of learning in the class room.

Basic Unit Objectives:

Please note that the following list of unit objectives is not in the order in which each concept will be be presented in the curiculum unit lesson plan section.The unit objectives are as follows:

1. to have students learn the relationship of Astronomy,Math,Music and the Scientific Method
2. to have students learn about sound waves:
    a. amplitude
    b.phase
    c.acceleration
    d.velocity
    e.displacement
    f.standing waves
    g.resonance
3. to have students learn about light waves:
    a.electromagnetic waves
    b.polarized light
    c.the speed of light
    d. reflection and refration
    e.optical fibers
    f.radiation
    g. fission
4. to have students learn the nature of light and matter
5. to have students learn Units length, time, and mass
6. to have students learn about Kepler and his three laws
7.t o research what is currently being done in radio astronomy,

8. to have students understand the correlation between the use of the doppler effect and the difference bewteen it’s properties related to sound and light waves
9. to have students learn how to use computers and the internet to retrive images taken by the Hubble telescope.
10. to have students learn to use and gain an understanding of how the oscilloscope works and how it’s application might assist them in the understanding of contemporary scientific discoveries involving light waves.Students may also learn how that particular type of study of light and sound waves can be applied to learning contemporary astronomy and cosomology.

How to Adapt This Curriculum Unit for High School Grade Levels

Since the objectives and strategies are different for each grade level and type of student taught, objectives and strategies shall be covered as follows:

1. Freshman
2. Sophmore
3. Junior
4. Senior

5. Special Students

If you are a Music, Special Education, or Art teacher teaching at the elementary school level, you can adapt your activities for each grade and class that you teach by taking central concepts presented in each lesson. The Freshman year in general might be viewed as the “Romance” years in high school.The Sophomore and Junior years might be viewed as the “Precision” years. The Senior year could be the year where skills are generalizied and applied for the introductory levels of college study.

Freshman level

Most freshman students have a very active immagination.I would stress concepts that are not too skill based to adapt from this unit. For example, I would not give freshman precision exercises from the radio astronomy section, as the math skills, histrocial prospective, and basic scientific concepts have not been studied and might serve to undermine your central objectives.I would recommend using all of the “romance” sections, and simplfiing the “Pecision” sections to fit the skill level and needs of your students. The “Generalization” sections will also be based directly on how you develop the “Precision” section.

Freshman tend to need reminders of “productive” class room behavoir.I find this esspcieally true when attempting to present differrent disciplines in the same class room.If you are using film clips, you might have film clips used as a reinforcer of appropriate class room behavoir.The first couple of classes might be spent setting up ground rules and introducing your self and the students to each other.

This level of student might benefit from having each discipline presented individuallay first. After each section, slowly introduce the relationships of one central idea from the prospective of two diciplines.They can document their observations in their observation journal.

Sophomore

The sophomore student at this level should have had at least one year of high school math, science, an English course, and an arts class. The “Precision” section of this unit might be usefull for this grade level. This might also be an excelllent way to develop a team teaching strategy with other teachers in your school system. Central concepts might be targeted as important skill areas to focus on during the school year.

While sophomore students claim to be “too cool” to study basic concepts, from each discipline, an Interdisiciplinary approach might be what the doctor ordered. Each student might be asked to provide a study of this unit from the prospective of a discipline of his or her choice. This approach also encourages each student to think creativly as well as independantly.

The “Romance” or introductory section of the unit might ask each student to write an essay on how each student sees the sky and perhaps how a dancer might view the stars as oppossed to how a doctor might view the night sky.

Junior

This unit can be used “as is” the for the junior or senior high school student. The junior level student might have expressed an interest in a particular field. This type of class might encourage juniors to explore more fully what skills they need to develop in order to pursue that field of interest in a creative way. Hobbies are also a fun way to learn more about the environment and world. Most of the disciplines represented here might also make fun hobbies for students.

This type of unit could also be created to match activities pursued by honor soceties or clubs that have national chapters.The activties developed could be designed to interact with your local community and local professonals.Leadership skills as well as media recognition might be built into this type of unit.

Senior

The senior student might have not only expressed an interest in this type of unit, but might have applied to a college for which he or she can prepare himself or herself for future study of music, science, astrononmy, asoustics,social work,linguists, or perhaps a phonetics, etc.

The “Generalization” sections of this unit might be more interesting than either of the other two sections designed within the scope of this unit for the high school senior.As an elective, this unit might be adapted to fit the needs of a graduating senior.One might stress how to obtain infromation from variuos sources, such as the Internet, or use of the Library.

The teacher might also invite a guest lecturer to speak on a particular topic of interest during the course of this type of unit.Students are often surprised to find out that lawyers can play the viola well, or that doctors know a lot about constellations in the sky.

The study of waves can be applied to almost any form of study. As all disciplines are realted in some form or way, this unit could be used to demonstrate some of the basic realtionships presented in tandum.

Lesson one: The Oscilliscope and Looking at Sound Waves

Part one—Romance Section:

“Conceptual thinking is built on visual understanding”

Johann Pestalozzi
First divide your class into groups of students with five members in each. Explain that each group will be drawing or graphing pictures viewed from the special oscilliscope that is in the front of the room.But, first there are some things to learn before they can see the waves clearly on the very small screen.

Have a hat or a small box with numbers ranging from one to four. Have each group come up tto the front of the room and pick a number out of the hat or box.You can also just assign numbers to each student in the group if desired.

After each student is in a group and has a number from one to four, explain that each number in their

particular group will be learning how to operate a different function on the oscilliscope.

The first group at the oscilliscope will be shown by you, how each knob fucntions.The parts of the oscilliscope are as follows:

1. the intensity knob:
   the intensity knob is used to control the strength of the beam in side of the scope. If the beam of light is too light to see on the screen, this would be the knob to turn or adjust.
2. the Focus knob:
   The focus knob is the knob that controls how sharp or fuzzy the beam of light will look on the scope. If the beam of light in the screen part of the scope appears to be very fuzzy, then you will have to adjust it so that the beam of light in the shape of a wave can clearly be identified on the screen.
3. Trigger Level:
   the Periodic nature of the wave form on the screen can be identified or made easier to find by adjusting this knob.This knob if not in proper adjustment , will flatten the signal on the screen to the point where you can not identify the wave pattern on the screen. This setting controls the amplitude of the wave.
4. Time/divstion:
   the knob that controls the time or the speed of the sweep of the light beam seen on the screen is measured in milli seconds. Adjust this knob or setting so that the wave takes on the form of a pure sine wave, or saw wave ect.
5. If the oscilliscope has two inputs (which is desireable), Channel A Postion, and Channel B Position. This is a part of the Vertical gain.
   the knob or knob that controls this section are used to place the beam of light on the target of the screen.
6. Volts/Divsion both for A and B:
   the volts knob is used to boost the gain of the signal coming into the scope.The knob will adjust the size of the wave form on the screen.
7. the Screen, which has a graph built into it.
   the screen does not need any spcieal adjustment.
8. (microphone); you might need some spceial wires in order to attach this to the oscilliscope.
   the micophone should not be the type that one would use for a good recording session. This is due to the fact that the signal would be too weak with out some sort of pre amp.A simple micophone that comes with a inexpensive tape recorder will do nicely.
9. optiional, Sound Generator, such as a electric key board ect.
   I plan to use a D-5 sound generator in order to make different sound wave on the scope. Any electric sound board will do in this case. If your scope has two out puts, use one for the mike and one for the key board instrument.
10. Have a tuning fork, Pot top, Glass , or other sources of sound in order to make different types of sound waves.
11. Have students of the first group make whistling sounds into the mic.Have a student draw the wave pattern seen in the scope.
12. Have the first group show the the second group how to operate the scope and so on until each group has used the scope to indentifiy a different sound wave on the scope.
13. Have each group present what they have found on the scope for the end of that class.

14. Have each group keep their picture for furture reference.

Lesson Two: Cosmology of the Past

This lesson shall take into account the concepts of Cosmology from 1619.In order to teach this lesson you will need the following:

1. Tape, “Harmony of the World”; A Realization for the Ear of Johannes Kelpler’s Astronomical Data from Harmonices Mundi 1619, Realized by Willie Ruff and John Rodgers 1985 The Kepler Label.
2. The Companion Article to the Tape from American Scientist, Vol. 67, No. 3. May-June 1979, pp. 286-292 Kepler’s Harmony of the World: A Realization for the Ear by Yale Profeesors Willie Ruff and John Rodgers.
3. A map of the Solar system that is either visible to the class or a hand out that shows all of the planets. There might be a over head or poster in the front of the class that can be used.
4. A piano or electric keyboard; if you are using an electric keyboard, make sure that the ranges

is at least four to five octaves.
5. Notations for the Planets both modern and medieval nomenclature described by Kepler;

Figure 6. provides the medieval notation while this unit will have a transcription of the planets to bass and treble clefs.

This lesson should precede the study of intervals. Depending the class, you might want to introduce the concept of the overtone series if it has not been done so as well as concords such as the octave, the fifth, or the major third and how those intervals represent simple but exact numerical ratios like 2:1, 3:2, or 4:3 before this lesson.

At the start of the class, play the first five minutes of "The Harmony of the World" Side 1. Do not tell the class what you are playing. After listening to the tape, have the class explain to each other what they have just heard.

Present three pictures of the different views of the solar system throughout history; that include the present day view, kepler's view of the solar system and Copernicus circular orbits of the planets.

Have a student come up to the keyboard and play the notes for mercury from the modern notation provided in this lesson.

In conclusion, discuss the relationship between kepler's involvement in both music and astronomy. Also discuss how the early Greeks reasoned heavenly revolutions must exhibit the perfect form, the circle as seen later by Copernicus's circular planetary orbits. Without becoming side tracked with math equations show the import of Kepler's laws and the planet's elliptical orbits. [2]

Lesson Three: Introduction to Radio Astronomy

For this lesson you will need the following:

1. the Nova Educational VCR Tape "Is There any Intelligent Life Out There ?"
2. A map of the solar system

First, you are going show the first section of the tape mentioned above. This section shows a group of scientists looking at a screen that appears to be very much like screen of an oscilloscope. The segment that is being referred to shows a spike on the screen. After the spike is seen on the screen the group of scientist

become very excited.

Show the VCR tape segment two times. The first time tell the students as little as possible about what they are about to see. I would also turn the sound off during the first showing. This segment referred to is about five to ten minutes in length.

Ask the class to explain what they might have seen. Ask the class what was the spike in the tape ?

Why were the scientist so excited ? Where are those in coming signals coming from ?

On the second viewing play the tape with the sound on so that students can follow the events only seen before. After the second viewing, explain that the scientist are studying radio waves.

Ask the class questions such as, how fast does was the signal traveling ? How strong is the signal?

In conclusion, explain it a radio signal came from the nearest star let as say six or seven light years away, how long would it take that signal to travel from Pluto to earth, and from the earth to the sun?

Hand out journals, and have students write personal observations.

Give words as a home work assignment. Have students bring back the definitions of each word and tell what section in the journal each word should be placed in.

(figure available in print form)
Figure 3. Kepler's ideas about the movements of the planets were based on the sun-centered planetary system of Copernicus, shown here in a drawing from *On Revolutions* , Book 6, published by Copernicus in 1543, the year of his death. In this schematic figure. Copernicus showed the orbits as circular. Kepler discovered that they were actually, elliptical. (Courtesy of The Beinecke Rare Book and Manuscript Library. Yale University.)
(figure available in print form)
Figure 6. These notations for the pitches of the planets were described by Kepler as "the single movements [of the planets] in the familiar terms of notes. Ghey do not form articcxulately the interfmediate positions, which you see here filled by notes, as they do the extremes, because they struggle from one extreme to the opposite not by leaps and intervals but by a continuum of tunings and actually traverse all the means (which are potentially infinite)—which cannot be expressed by me in any other way than by a continuous series of intermediate notes." (From Johannes Kepler, *Harmonices Mundi* .)

Figure I. medieval and Modern Notations

(figure available in print form)

Notes

1. If students are bored to tears in this section, then this segment might be too technical or dry. The other possibility is that students were not inspired by the first section, in which idea was

introduced.
2. There might be reason to mention Ftench and Italian music of the Fourteenth Century. The modern time signatures such as 4/4, 3/4, 6/8 , and 2/4 were in part developed by the medieval concept of “perfect” and “imperfect” time.

Making Academic Skills Your Own Through the Exploration of Music and Science.

READING LIST:
“ *VISUAL THINKING* ” by Rudolf Arnheim

“ *UNDERSTANDING MUSIC WITH AI / PERSPECTIVES ON MUSIC COGNITION* ”

by Mira Balaban, Kemal Ebcioglu, and Otto Laske

“ *LEARNING SCIENCE THROUGH SCIENCE FICTION FILMS* ”

by Leroy W. Dubeck, Suzanne E. Moshier and Judith E. Boss

“ *UNDERSTANDING MUSIC* ” by Janet Moore

“ *FILMING LITERATURE* ” by Neil Sinyard

“ *TEACHING THE MEDIA* ” by Len Masterman

“ *CREATIVE DRAMA IN THE CLASS ROOM* ” by Nellie McCaslin

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