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ABSTRACT
                Although theoretical work has been done on the nature
of metaphors, there is little that deals directly with the use of
metaphoric language in the teaching of regular school subjects. Yet
it is clear that metaphors, and metaphoric thinking, may be used to
great advantage in clarifying and elaborating on ideas, and in
helping students to develop their critical thinking skills so that
they can move from the concrete and the familiar to the abstract and
remote. (Metaphoric thinking involves thoughts and ideas, and ways of
looking at things, that are formulated and expressed in figurative
language.) To foster their 10th-12th grade students' ability to use
metaphors, a group of Newark, New Jersey teachers associated with
Project THISTLE (Thinking Skills in Teaching and Learning)
collaborated on a classroom research project on metaphoric thinking.
After various experiments they designed and used a strategy in which
students (1) explored the meaning of metaphors in everyday language,
(2) analyzed more formal metaphors from their own subject areas, (3)
created their own metaphors, first for familiar concepts and then for
more abstract concepts, (4) created metaphors for subject-related
concepts, and (5) evaluated the final metaphors in general classroom
discussions. The experiment made it clear that metaphoric thinking is
particularly useful in the development of critical thinking skills.
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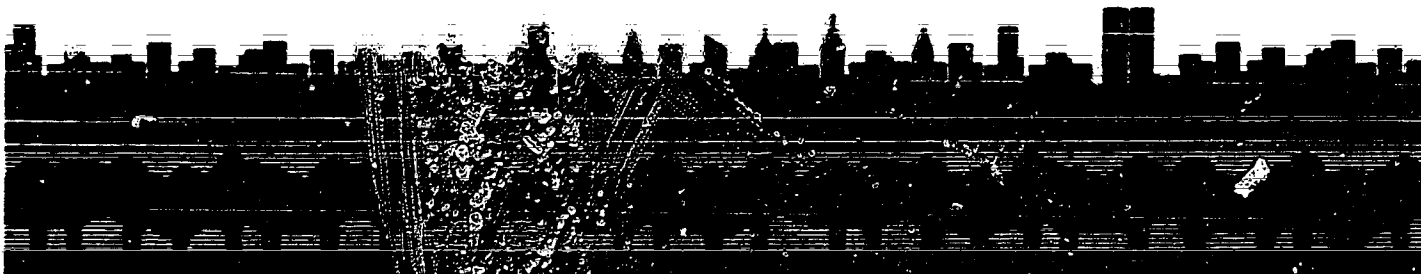
"Ei *idole and Walking Shadows*":
Metaphoric Thinking in Schools

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Paper presented to the
American Educational Research Association
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Project THISTLE: Thinking Skills in Teaching and
Learning was developed by Montclair State College faculty in
collaboration with the public schools of Newark, New Jersey.
It was designed to improve the basic skills of urban
college-bound high school students, and thus their chances
of success in college, by working with their teachers in an
integrated process of curriculum and staff development.
Since 1980, more than 100 Newark teachers have participated
in Project THISTLE's program of graduate course work in
curriculum development and basic skills instruction,
supervised classroom implementation, and elective
professional development activities.

Project THISTLE, funded in part by the New Jersey
Department of Higher Education and several local
foundations, cuts across disciplines to focus on thinking as
an essential, integral part of both subject area learning
and "higher order" basic skills development, particularly
reading comprehension, analytic writing, and mathematical
reasoning and problem solving. Project THISTLE helps
classroom teachers in the various disciplines develop more
thoughtful, consistent versions of their own curricular
plans, with particular attention to the development of
students' thinking skills.

Improvement in thinking skills would, it was expected,
be reflected in improved performance on traditional
standardized tests of basic skills, as well as in classroom
performance. Students of Newark teachers, in grades 10-12,
doubled their annual growth rate in reading comprehension,
from an average rate of six months in a ten month period to
a rate of twelve months, demonstrating the effectiveness of
the project (Oxman and Michelli, 1984).

Project THISTLE's curriculum development processes have
been, by design, ideosyncratic, as each individual teacher
is helped to improve their own curricular plans, using ideas
and resources identified in the process of collaboration
with college faculty and with their own colleagues. Some of
these ideas have been very exciting and fruitful, both in
the curriculum development process and in suggesting
explorations into the nature of thinking skills themselves,
in collaborative research efforts. This paper on metaphoric
thinking is among the outcomes of one such effort.

During a class session in one of the curriculum
development courses, a high school science teacher, Al
Mattia, demonstrated a principle of physics, using standard

laboratory equipment. In response to the questions of his
colleagues and teachers, he elaborated on his explanation by
using a metaphor. "It's like the difference between walking
on snow in low-heeled and high-heeled shoes," he said. The
person's weight is the same, but the high heeled shoes exert
pressure over a smaller area, and thus make a deeper
impression." "Oh!" we said, as we finally grasped the
principle he was explaining. Al's metaphor helped u
understand by relating something new to something quite
familiar.

The understanding of metaphors like these is a
fundamental thinking skill involving both linguistic and
cognitive comprehension, we realized. Like most thinking
skills, metaphoric thinking receives little attention in
school materials or instructional processes. Students are
rarely helped to develop facility in comprehending and
producing metaphors. Direct instruction in metaphoric
thinking is almost unheard of in high school subject area
classrooms; in fact, there is little reflective thinking of
any kind in schools in general (Goodlad, 1983; Oxman and
Barell, 1983).

During the summer, 1982, a small group of teachers
volunteered to collaborate on a joint research project to
develop classroom activities within which to incorporate
"metaphoric thinking skills," and to report the results.
Al Mattia (Science) Leslie Jenkins (Social Studies), Wanda
Davis (Science), Janice Findlay (English), and May Samuels
(Mathematics) participated, as did Sarah Sutton (English),
who later reported in Project THISTLE's newsletter (1983)
that

> The activities used in this investigation
> provide some useful insights about the need for
> "metaphoric thinking." Examining ideas and
> concepts metaphorically stimulates critical
> thinking, enables one to look at things
> differently, sheds light on areas that could
> have remained dark, reveals students'
> understanding of concepts, adds vividness and
> color to language, and helps to make ideas more
> meaningful to students (p. 3).

In a related effort, a different group of Project
THISTLE teachers began a systematic search for textbook
examples of the use of metaphor, some of which are used
herein. This paper is presented in two sections. First,
related literature on metaphors and metaphoric thinking in
subject area classrooms is reviewed and discussed. In the
second section, the processes used in the collaborative
research effort on metaphoric thinking in classrooms are
described.

Related Research on Metaphor and on Metaphoric Thinking in
Subject Area Classrooms

    Although direct instruction in comprehending and
producing metaphors in subject area classrooms is rare,
metaphors themselves are an integral part of our linguistic
heritage and are often used implicitly in instructional
communication (Honeck and Hoffman, 1980). Examples used in
this section have been drawn from school materials in
common, current use.

    The nature of metaphor. The word metaphor, used in
a generic sense, refers to figurative language, including
figures of speech, personification, hyperbole, puns, slang,
and other forms of non-literal images. Closely related to
metaphors are models and analogies. In many ways, the
purpose of these forms of communication and the strategies
by which they are comprehended involve the same cognitive
processes (Rumelhart and Norman, 1981;Davidson, 1976).

         (1) Every cell in your body is a small
             power plant (Otto et al., 1980)

         (2) The dinner was a culinary orgy
             (CEEB, 1982, p. 35)

    The examples of metaphor shown above, drawn from a high
school textbook and a sample Scholastic Aptitude Test, are
understandable only by analyzing the elements of two domains
of knowledge in terms of similarities and differences, and
synthesizing those elements that are relevant to both
domains into a new conceptualization. In this way, the
meaningfulness of knowledge in both domains is clarified,
enriched, and strengthened. Complex thinking is required to
create meaning from the metaphor.

    In the successful use of a metaphor, a set of ideas
from one domain is understood in terms of a set of ideas
from another domain. The word metaphor itself conveys the
idea of its origin, as it is derived from "meta," meaning
"trans," and "pherein," meaning "to carry" (Ortony, 1975).
Metaphor, then involves the carrying over, or transferring,
of meaning from one knowledge domain to another,
comparatively, from a more familiar area of knowledge to a
less familiar one, or interactively, from each area to the
other. In order to understand a metaphor, then, one must
work toward a comparison which yields both similarities and
difference, an analytic higher order thinking skill which
deals with what Black (1975) refers to as the "associated
implications" of the comparison.

    Typically, a word or phrase which is commonplace or
otherwise well understood is used metaphorically as a

vehicle to help in the understanding of something less well
known or familiar, called the topic, or the tenor, of the
metaphor.

> (3) An (algebraic) formula is a sort of
>   recipe for doing a certain kind of
>   calculation. (Keedy and Bittinger,
>   1976, p. 104).

> (4) An equation is like a balanced scale.
>   (Denholm et al., 1977, p. 17).

In presenting these metaphors in students' textbooks,
the authors are assuming that the students understand the
nature and function of recipes and scales--the vehicles of
these metaphors, and that this knowledge is likely to be
helpful in helping new algebra students understand the
nature and function of formulae and equations--the topics of
the metaphors. Vehicle and topic are never identical; those
identities or similarities which underly both topic and
vehicle, and which form the basis for understanding the
metaphor are refered to the ground of the metaphor; those
aspects of the two areas of knowledge which are dissimilar
are called the tension of the metaphor.

Following Ortony (1975), no distinction is made between
metaphor and simile; similes may be regarded as metaphor in
which the ground--the basis for similarity between topic and
vehicle--has been somewhat clarified through the use of
"like" or "as."

Metaphors can sometimes be so well integrated into our
everyday--and even professional--use of language that we are
unaware of their figurative origins. These "dead," or
"frozen" metaphors, such as "pitfall," "lukewarm" (used to
refer to a level of enthusiasm," "fly-by-night,"
"dog-eared," "backlog," may be understood either literally
or metaphorically, depending upon one's prior knowledge and
experience with the terms; that is, depending on whether the
metaphor is "alive" or "dead" for a particular individual.
These particular metaphors, it should be noted, are
considered so important a part of our language heritage that
they all appear in Scholastic Aptitude Test sample items;
similar ones appear on the tests themselves.

Metaphoric comprehension. Understanding a live, or
active metaphor involves intellectual transformations and
constructions in an effort after meaning, and includes the
stages of error, in which literal interpretations are
attempted, puzzlement, and resolution (Pollio et al., 1970).
Alternatively, the stages of anomoly, thought experiment,
and correction, with iterations are involved (Petrie, 1979).
Sticht (1979) notes that these stages of metaphoric
comprehension conform to the basic process of inquiry, or

problem solving.   The work of metaphoric comprehension
procedes until the relevant associations between vehicle and
topic are identified, and the ground and the tension of the
metaphor are distinguished.

        By nature, metaphors introduce novelty, uncertainty,
complexity and ambiguity, all elements of paradox and
surprise that create cognitive dissonance. Metaphors, then,
may be intrinsically motivating (Berlyne, 1965), eliciting
the "epistemic curiosity" and analytic thought necessary to
solve the problem of comprehension. Sticht (1979) argues
"by analogy, that just as the repeated use of a hammer may
strengthen the arm, the repeated use of metaphors may
strengthen the power of analysis and synthesis (p. 485).

        The process of comprehending a metaphor typically
involves the construction of a mental image: an image that
is built of elements from the vehicle, the more familiar
knowledge domain under consideration, and gradually refined
to eliminate non-relevant elements. This mental image,
which is often visual, is called an "experience-like
representation" (Ortony, 1975). Metaphor, he notes, lies
much closed to perceived experience than a non-metaphoric
equivalent" (p. 48); a vivid image transferred via metaphor
communicates in a single "chunk" a wealth of information
rich in detail and personal experience, perhaps with
emotional associations as well. The vividness of the
metaphor, and its closeness to meaningful personal
experience, according to Ortony, accounts for its
memorability and usefulness in learning. The textbook
explanation presented in (5) and (6) demonstrate these vivid
representations.

        (5) Genetic reassignment is like
            shuffling a deck of cards.

        (6) The "infant industries" were like
            small children competing with grown men.

        Through metaphor, various frames of reference and
points of view (themselves metaphors for "multiple
perspectives") can be made explicit and considered in the
course of educational discussion. Learning to relate things
in a variety of ways is a fundamental cognitive skill,
emphasized by Piaget (1975) in terms of formal operations
and by Cole et al. (1971) and Scribner (1975) with
regard to distinctions between schooled and unschooled
people from pre-literate cultures. Such varied frames of
reference may result from the metaphor creator's ability,
more evident in formal operations, to "entertain multiple
attributes" (Galda, 1981) That is, to play with a number of
possible variables, ideas or aspects of topic and vehicle.

For many students, the use of metaphor helps in
overcoming a reluctance to consider hypothetical or
imaginary circumstances--what Green (1979) call a "kind of
incapacity to entertain counterfactual conditionals" (p.
471) such as that posed in questions like "What if Columbus
had not discovered America?" at least in educational
contexts. This incapacity may be due to overlearning of the
bias toward literalness and explicitness in written texts
and, according to Olson (1977), in school language
generally.

Metaphor and teaching. How are metaphors used in
education to motivate thinking, to achieve depth of
understanding, to facilitate transfer of meaning, to relate
school knowledge to personal experience? Metaphors have,
throughout history, been used as tools of communication
which were intended to function as explicit pedagogical
devices. The 23rd Psalm (The Lord is my Shepherd) and the
cave images of Plato are examples of these.

Black (1975) emphasizes the "tight connections" between
metaphors and models, and notes that "every metaphor may be
said to indicate an analogy or structural correspondence (p.
31). Thus, there is a parallel between the understanding of
literary metaphors as figurative language in the study of
literature, and models or analogies, as in the "model" of
the atom as a miniature solar system in science, or the
"model" of fractional parts as pieces of a pie, or the
"model" of electrical current as a liquid flow.

The use of metaphor in such passages as

(7) Josephine strutted into the
    room in full plumage.

would be unsurprising as a literature selection in reading
material for children; teacher guidance in understanding of
the meaning of passages like this would clearly be helpful
in later success on tasks such as the analogy item from a
sample Scholastic Aptitude Test in example (8)

(8) Apparel:person::

        (1) prey: animal
        (2) camel: water
        (3) plumage: bird
        (4) cat: tree
        (5) horse: racetrack

        (CEEB,1983, p. 35)

Guidance and practice in analyzing the figurative
references in science or social studies texts, such as

(9) No one gland or organ serves as the one
controller of the body. The nervous and
endocrine systems harmonize all the other
systems, but the music would lack its full
effect without the whole orchestra playing.
(Rosenberg et al, 1978, p. 116).

surely leads to increased ability to comprehend the passage
from a Scholastic Aptitude Test selection such as

(10) The first human being to emerge from
the earth's atmospheric envelope,
in the 1960's, were able to do so
because they packaged that atmosphere
in their amniotic spacesuits and spaceships.
(CEEB, 1982, p. 32)

The use of metaphor, then, is a "key pedagogical tool"
(Petrie, 1979, p. 460). Metaphors can have great heuristic
value in the teaching of new concepts, in providing
experience in the processes of analytic thinking and problem
solving, in bridging the gap between old and new knowledge,
and in making school learning meaningful in the context of
lived experience. In addition, they may be useful for
teaching alternative conceptualizations (Rumelhart and
Norman, 1981).

There are, however, arguments against the use of
metaphor in teaching. These arguments reflect attitudes
suggesting that, at best, metaphors have only decorative or
ornamental value, but are "frills," irrelevant to the
educational process; or, at worst, metaphors are misleading
and confusing, and thus harmful to immature minds (Pollio et
al, 1977). Pedagogical texts, and teachers' guides to
student texts typically reflect these attitudes and make
few, if any, suggestions for using metaphor effectively in
teaching. Current pedagogical knowledge regarding metaphor
includes the ideas that

1. Teachers should avoid metaphor because

     a. children have enough difficulty distinguishing
between truth and falsehood as it is, and would be confused
by the introduction of partial truth, particularly by the
teacher in authority.

     b. implied similarities can too easily be confused with
literal reality (Emig, 1972).

     c. metaphors may indeed be compelling and memorable,
but so are advertising and political slogans; they must be
avoided as misleading.

d. metaphor calls attention to language itself,
diverting attention from the real content of instruction,
and is thus distracting.

e. metaphor is a waste of time. The facts are known
and there is so much real content to cover.

2. Some educators, who feel that metaphors have some
aesthetic value, believe that

a. children can be assigned tasks involving the
composing of figures of speech in order to appreciate their
difficulty and the amount of work required to produce them
(Pollio et al, 1977).

b. metaphor can be used by students to add interest and
beauty to their creative writing.

c. metaphor belongs to the high school English
curriculum in which students learn the difference between
metaphors and similes in poetry.

Despite these cautions and delimitations, however,
metaphoric language "abounds" throughout children's
literature, textbooks and other educational materials.

Pollio et al. (1977) provide a literature review of a
series of studies of children's language arts textbooks,
texts for teachers, and educational materials in reading and
writing, noting that "metaphor, when treated at all, was
still taught largely as a neglected stepchild of a slightly
less neglected parent, poetry" (p. 196), in "marked contrast
to the actual occurence of figurative expression in
children's reading materials" (p. 198). This occurence is
"extraordinarily high, considering that little direct
instruction was given to help the child in learning how to
use or interpret such usage." Pollio concluded that "
children apparently are supposed to produce, comprehend, and
interpret figurative language without any direct teaching in
the mastery of such usage. Research studies have shown that
children do indeed have difficulty with metaphoric,
non-literal language, and need and can profit from such
direct instruction (p. 208).

Collaborative Research on Metaphoric Production

In this section, the processes used in the
collaborative research project on metaphoric thinking
conducted within Project THISTLE are described. Sutton
(1983) reported:

Several teachers participating in project
THISTLE embarked upon a project to challenge
their students to create metaphors for
fundamental ideas, concepts or principles
within their subjects. Once created, students
were asked to explain their reasons for the
kinds of relationships presented above.

To begin our project, a series of activities
was designed to make the students aware of what
a metaphor is through the analysis of some
common, everyday metaphors such as "she's a
real dog," "life is a bowl of cherries," etc.
Then we analyzed a metaphor from Macbeth: "Life
is but a walking shadow." Next, students began
warm-up activities -a kind of 'play' with
metaphors - by creating their own metaphors for
familiar concepts such as "school is...,
"writing is..." We continued these warm-up
activities with creative compositions such as
"what plant/animal are you like and why?"

These warm-up activities stimulated imaginative
and critical thinking in students because they
had to analyze the qualities of the concepts
and find similar qualities in concepts that
were entirely different. At this point
students were able to create metaphors for more
abstract concepts such as "thinking is...,"
"courage is...," "love is..."

The warm-up activities gave students the
opportunity to get involved in the critical
thinking processes necessary to understand and
use metaphors. To explore further the effects
of "metaphoric thinking," the next activities
involved applying metaphoric thoughts to
subject-related concepts. In creating
metaphors for subject-related concepts,
students first had to   identify the
qualities inherent in the concept and then
discern those qualities in another domain.
They had to involve themselves in critical
analysis and imaginative thinking that helped
them relate new concepts to their prior
knowledge. This relationship between the very
familiar and the slightly strange makes key
ideas such as imperialism, factorization, and
mitosis more meaningful."

    Our purpose, indeed, was to find ways for students to
make curricular concepts more meaningful and memorable by
providing direct instruction in metaphoric production. We
focused on helping students to create metaphors and then to

explore the meanings of the "associated implications"
relating to topic and vehicle. Thus, we worked on fostering
students' ability to understand important curricular
concepts and to make them more meaningful through metaphoric
production and the complex, often abstract thinking
processes associated with such production.

    The teachers, seven in all, represented every major
subject area in secondary school: language arts, social
studies, mathematics, and science. They worked with students
in grades 10 - 12 in two Newark high schools. The
motivation to participate in this pilot project stemmed from
several sources: their interest in challenging their
students to engage in reflective thinking in a novel
fashion; their desire to study the research literature in
their own subject areas; and their desire to participate
with colleagues in a new adventure that was part of a group
effort. From the outset, there were two major objectives
for teachers: to learn about metaphors and to learn to use
metaphoric comprehension and production as a way to enhance
their instructional programs.

    Learning about metaphors. One of the co-authors of
this paper and the seven teachers met after school to begin
learning more about metaphors. We read articles by Ortony
("Why metaphors are necessary and not just nice," 1975) and
excerpts from Black's *Models and Metaphors* (1962) and
Bronowski's *The Identity of Man* (1971) and *Science and
Human Values* (1956). Using these resources we examined
such metaphors as "Life's but a walking shadow..." to
determine how it might be a substitution, comparison, or
interaction (Black) between the principal and subsidiary
subject.

    We explored the "associated implications" of "Life" and
"walking shadow" to see if or how "the metaphor selects,
emphasizes, suppresses, and organizes features of the
principal subject (the topic) by implying statements about
it that normally apply to the subsidiary subject (the
vehicle)" (Black, 1962, p. 44). We were investigating the
metaphor as systems of related meanings, thus becoming more
familiar with how students might indeed expand their own
sphere of meanings by creating them. Holding to the
proposition that meaning refers to a system of "referential
associations" (Johnson, 1975), and that increased
meaningfulness results from extending one's network of such
associations, we found support for the notion that students
would benefit from metaphor creation. "Learning may be said
to be meaningful to the extent that the new learning task
can be related to the existing cognitive structure of the
learner, i.e., to the residual of his earlier learnings"
(Johnson, p. 427). Challenging students to create
relationships between major curricular concepts and their
own "earlier learnings" would seem, therefore, to be very

beneficial.

We also investigated Bronowski's work on metaphors and models as well as his view of the imaginations as that which opens the system so that it shows new connections (1978). From there it was a short leap to the view of Black and others that metaphors and models can be creative: "a metaphoric statement can sometimes generate new knowledge and insight by changing relationships between the things designated" (1979, p.37).

Thus, we learned about metaphor's interactive and creative nature preparatory to challenging students to think of their own metaphors for subject area concepts.

Designing a strategy. Next, it was important to design a way of working with students so that they understood what they were being asked to do and could fulfill the task successfully. During the course of several weeks we experimented with various kinds of learning experiences and settled upon the following:

1. Exploring the meaning of metaphors in everyday language (e.g. He's cool; that's a turn on)

2. Analysis of more formal metaphors from their own subject areas (e.g. Life's but a walking shadow, Ghandi looked in the face of a two thousand year old despair and stared it down)

3. Warm-up activities: creating metaphors for concepts such as school, writing, being a student, Monday mornings, etc.; creating metaphors for the self based on plants or animals (What plant or animal are you like and why?); and creating metaphors for more abstract concepts such as love, duty, courage, and thinking.

The warm-up activities gave teachers the opportunity to set the stage for asking students to create metaphors for significant ideas and concepts within their subject areas. For this final process, we devised an approach that was somewhat elaborate:

1. Identify a major concept.
2. Analyze its significant aspects, elements, etc.
3. Find a referent within your own experience with similar characteristics.
4. Match the topic and vehicle in a metaphor.
5. Evaluate the quality of the metaphor; that is, the degree to which there is appropriate "ground" and "tension" underlying the metaphor.

This process was based upon an earlier suggestion
(Barell, 1980) that metaphor making might be more
advantageous for students than constantly memorizing only
those that others have created. In actual practice, many
students were able to carry out these processes in their
heads without having to write them out. This ability, of
course, is a function of when during the instructinal
process they were creating the metaphors, at the beginning,
middle, or end. Our students were fashioning metaphors
after studying them rather extensively.

   Some results and observations. Teachers made a
number of valuable observations during the "warm-up"
process. "I observed that students who had demonstrated
formal operational abilities ... had less difficulty in
attempting to interpret such metaphors as 'Life's but a
walking shadow.' Some students," noted Sarah Sutton, "were
able to associate 'shallow' and 'without substance' to
shadows and Macbeth's life, whereas more 'concrete' students
could not readily make these kinds of associations" (Sutton,
1982). The educational benefit for these students derived
from the ensuing discussion. As Sutton noted, "their eyes
were opened by their peers to a different way of looking at
things." And these kinds of experiences are the complex
challenges that nurture more abstract thinking.

   Leslie Jenkins, a history teacher, noted that at first,
students gave definitions, rather than metaphors, such as
"School is ... a place to get an education." To stretch
their thinking about school, she challenged them to "think
of things in nature, religion, entertainment, construction,
or plant and animal life"(Jenkins, 1982). Jenkins also
noted that this kind of imaginative challenge placed
students and teachers in a relationship different from the
one of "institutionalized dominance and subordination" that
too often predominates. She struggled with giving students
"room for the exercise of initiative." "It is hard," she
continued, "for a teacher to drop the habit of looking over
the students' shoulders." As in all experiences that
challenge students to go beyond the obvious, or to transcend
the system to reveal new connections, the adult loses a
degree of control; students themselves forge the linkages
that make the concepts meaningful to them.

   Another observation is important. Once the metaphoric
statements had been completed within the classroom
activities, each teacher conducted a general discussion that
evaluated the "fit" of the metaphor. It was during these
discussions that students learned from their peers, were
able to point out strengths and weaknesses of various
metaphors, and quite often, new metaphors were generated out
of the discussion. As Johnson and Johnson (1979) noted,
creative production is fostered by this kind of diversity of
input within a collaborative, trusting setting.

One final note on the evaluative process. It was
during this phase that Leslie conducted a debriefing with
one student who said, "Democracy is a parking lot." While
analyzing the systems of associations point by point, he
commented, "You know, I've never thought so much about my
own thinking before." This metacognitive, reflective
statement may be one of the most important unintended
outcomes of metaphoric creation.

Student productions. Many of the students'
metaphoric statements reveal their cognitive abilities as
well as their understanding of the concepts presented to
them by the teachers. These were the concepts teachers
selected: Theme (language arts); Imperialism, Colonialism
(social studies) and Factorization (mathematics).

> Theme is getting to the middle of an
> artichoke. You get to the middle and you see
> what made all the leaves. That is the root of
> it.   (LaTanya)

> Theme is a pomegranate. Every little seed
> of the pomegranate is a part of it just as
> every element of a story is a part of the
> theme. (Robert)

> Imperialism is like a shark. A shark
> seems to own or have power over less powerful
> fish...Colonialism is a pimp who takes all the
> money,.Autocracy is a game of "Simon
> says"....Factorization is like slicing a cake
> and eating it piece by piece.

Observations and insights. Many useful insights
were gained by teachers participating in this experience,
including

1. Comprehension of metaphor is a function of cognitive
development. Teachers were able to discern differences
between more concrete and abstract thinkers in their
analysis of metaphors presented to them and those created by
their peers. Students who created definitions rather than
metaphors for key subject area concepts may be more concrete
than a student like LaTanya who wrote that "theme is getting
to the middle of an artichoke."

2. The process of creating metaphors is a viable means
of developing and assessing students' understanding of
concepts critical to any subject area. Furthermore, the
mental processes required to make such a metaphoric
statement as the one about artichokes requires analysis,
synthesis, and evaluation on the student's part and is,
therefore, a very complex mental operation.

3. Metaphors created during "warm-up" activities with "school" as the "topic" often revealed elements of the "hidden curriculum" with students comparing schools to prisons, for instance. Teachers challenged students to be more positive, but what their initial reactions revealed disclosed was a rather thorough negativism. One student in May Samuel's class noted, "Being a student in this class is like living in the jungle and being the only zebra." Her feelings of alienation was a surprise to the teacher.

4. Teachers' library research on metaphoric thinking in their subject area fields revealed very little, if any, examples of the kind of learning experiences they were presenting to these Newark high school students. Some research had been done on students' abilities to comprehend metaphors presented to them. As noted above, we discovered students' difficulties with such abstract metaphors as "life's but a walking shadow..." Our students with more formal thinking abilities had less difficulty, not surprisingly, than those who were more concrete. If, as Galda (1981) asserts, understanding metaphors "requires the ability to entertain multiple attributes," it would seem logical that participating in classroom experiences in interpreting and creating metaphors might foster the kind of complex abstract thinking described by Piaget as developing during adolescence.

5. Finally, it seems necessary not only to interpret and create, but to engage in critical evaluation of one's own and others' thinking. Leslie Jenkins presented her students with the conventional Melting Pot theory of American assimilationism. She required her students not only to understand but to challenge it. Students were asked to evaluate its applicability and appropriateness for what occurs in our society. Similarly, we should afford students opportunities to examine critically other metaphors and models encountered in subject area content; e.g. the "domino theory," etc.

Several members of the group of participating teachers completed their work by presenting an in-service workshop for more than 100 of their colleagues on the metaphoric thinking project, under the direction of their college instructor. The workshop was so well received that further work on metaphoric thinking within Project THISTLE has been planned.

Summary and Epilogue

Metaphoric thinking involves thoughts and ideas and ways of looking at things that are formulated and expressed in figurative language. Although there is theoretical work that has been done on the nature of metaphore (see, for

instance Ortony, 1979; Honeck and Hoffman, 1980), and the
understanding and use of figurative language is taught as
part of English literature and creative writing, there is
little in the research literature in the field of education
that deals directly with the use of metaphoric language in
the teaching of regular school subjects. There are a great
many books on curriculum and methods of teaching that do not
mention it at all, and yet it is clear that it may be used
to great advantage in clarifying and elaborating on ideas,
in helping students move from the concrete and familiar to
the abstract and remote; from the known to the unknown.

Metaphoric production involves both creative and
critical thinking; creativity to dream up metaphors like the
ones produced by our Newark high school students: "research
is a hiking trip," "an outline is a road map;" and critical
evaluation to judge the extent to which the metaphor is
appropriate or misleading ("democracy is a parking lot;"
"footnotes are like feet").

Students of our Newark teachers involved in this
project found the instruction valuable, according to their
teachers, as they often used metaphor spontaneously in later
classroom activities. One student, frustrated with the
inattention of others to an assigned group task commented
"Working with this group is like trying to gather blowing
leaves." Another student asked a teacher in the course of
an unrelated discussion "May I answer that question
metaphorically?"

We embarked upon this project in order to assist
students in extending the meaningfulness of curricular
concepts by engaging in creative and critical thinking.
Hannah Arendt (1977) noted that "analogies, metaphors and
emblems are the threads by which the mind holds onto the
world...moreover, in the thinking process they serve as
models to give us our bearings..." This kind of activity is
natural for all of us. In schools, however, there is
typically no time spent creating and critiquing those models
and metaphors that help us to interpret our experience.
Throughout the course of this project, it has become clear
that interpreting and creating metaphors for key curricular
concepts in subject area fields is a particularly useful
classroom activity in helping students seek out and create
meaning from experience; that is, in helping students
improve their "thinking skills."

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