DOCUMENT RESUME

ED 370 786 SE 054 448

AUTHOR	Tobin, Kenneth
TITLE	Metaphors and Images in Teaching. What Research Says to the Science and Mathematics Teacher. Number 5.
INSTITUTION	Curtin Univ. of Tech., Perth (Australia). National Key Centre for Science and Mathematics.
REPORT NO	ISSN-1033-3738
PUB DATE	Apr 90
NOTE	9p.
PUB TYPE	Information Analyses (070)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Educational Research; Elementary Secondary Education; Foreign Countries; Higher Education; Instructional Improvement; Mathematics Education; *Metaphors; Science Education; *Science Instruction; Science Teachers
IDENTIFIERS	Australia

ABSTRACT

Examples are drawn from an ongoing research program conducted in Australia and the United States to help explain how metaphors and images are associated with salient teaching roles and belief sets. This document is partitioned into five sections: (1) method; (2) metaphors and images; (3) teacher change; (4) what we learned from these studies; and (5) some questions for the consideration of science and mathematics teachers. (ZWH)

The Key Centre for School Science and Mathematics

What Research Says to the Science and Mathematics Teacher Number 5

curtin
University of Technology
Perth Western Australia

METAPHORS AND IMAGES IN TEACHING

Kenneth Tobin
Florida State University

METAPHORS AND IMAGES influence how teachers think and talk about teaching and what they do in the classroom. Teachers do what makes sense to them in the circumstances. What has worked in the past in a given context guides a teacher's selection of appropriate practices. However, decision making often is not conscious.

Ongoing research with science and mathematics teachers (e.g., Tobin & Ulerick, 1989) suggests that the metaphors used to conceptualize particular teaching roles guide many of the practices adopted by teachers. In addition, teachers assume roles in business, social, sporting, family and political facets of their lives. Images projected in these various roles evolve over the years and become a part of a person's 'self'. As a teacher moves from one activity to another throughout the day, images which are projected consciously during one activity might be suppressed in another or might be evident, but less prominent. In other instances, a teacher consciously might project an image from another role in order to gain the respect of colleagues and students.

The purpose of this publication is to explain how metaphors and images are associated with salient teaching roles and belief sets. Examples are drawn from an ongoing research program conducted in Australia and the United States in the past six years (e.g., Tobin & Espinet; 1989; Tobin & Gallagher, 1987; Tobin, Kahle & Fraser, 1990; Tobin & Ulerick, 1989). The following sections discuss (1) method, (2) metaphors and images in teaching, (3) teacher change, (4) what we learned from these studies and, finally, (5) some questions for the consideration of science and mathematics teachers.

METHOD

Teachers' metaphors and images were identified from verbal accounts of teaching and learning. Metaphors were obtained from teachers' responses to interview questions or from their descriptions of a recent lesson. Teachers also were invited to describe how they use images to think about teaching and how images and metaphors are related to each other. Interviews conducted after an observed lesson or in conjunction with videotaped replays of

teaching are ideal sources for data on metaphors and images.

EXAMPLES OF METAPHORS AND IMAGES IN TEACHING

GARY DID NOT have many problems with discipline in his teaching of science, even though misbehaviour of students was a widespread problem in the school in which he taught in Australia (Tobin & Gallagher, 1987). Gary, a martial arts instructor and holder of a black belt in karate, adopted a metaphor of *teacher as intimidator*. The images which he projected in his science classes frequently were carried over from his hobby as an exponent and student of martial arts. Thus, his posture, movement around the class, and intent stare at potential trouble-makers easily could have belonged in a karate contest. These images were a deterrent to most students who might have contemplated misbehaviour. Gary was not intimidated physically by students in his class and he was not prepared to accept unruly behaviour from them. Gary was an authority figure who demanded the respect of students because of his managerial style.

Jonathon, an American science teacher, used a metaphor of *teacher as preacher* to make sense of teaching (Tobin & Espinet, 1989). In his life outside the classroom, Jonathon was a preacher. As a teacher, he lectured from the front of the class and set seatwork tasks from the textbook. His lectures had many of the characteristics of a sermon, the textbook was his bible, and his role in the classroom was consistent with the roles which he fulfilled as a preacher. In the classroom, Jonathon projected an image of a preacher.

Sandra, an Australian high school science teacher (Tobin, Kahle & Fraser, 1990), allowed students to learn together in groups or to complete tasks independently. The metaphor of *teacher as resource* appeared to define Sandra's role and constrain her from behaving in certain ways. For example, few whole-class activities were conducted in 10 weeks of observation of teaching and, when they did occur, they were of short duration and were intended to clarify the schedule or provide details related to the administration of the program. Sandra was untiring in her efforts to share the teacher resource among the student consumers. To the extent that she was free to do so, Sandra responded to student needs by answering questions, providing explanations and generally assisting students to remain cognitively active. Even when Sandra visited a group, she usually interacted with two or three of the students at the table on an individual basis. Few visits to groups exceeded 30 seconds in duration.

One of the metaphors which Shirley used when she taught her primary mathematics class was *teacher as movie director* (Tobin & Jakubowski, in press). In the previous two years, she had changed from being a traditional teacher of mathematics who relied on the textbook and focused on rote learning of

One of the metaphors which Shirley used when she taught her primary mathematics class was teacher as movie director.

facts and algorithms to get correct solutions. Now, she was a teacher who facilitated learning with understanding based on problem solving and cooperative learning, which involved students working together to arrive at consensus solutions to problems. Shirley used the director metaphor to make sense of her teaching role in a teaching and learning environment with which she had no previous experience. The director provides actors (i.e., the students) with a script, but it is

left to the actors to create their own parts within the confines of the script. The actors cannot succeed unless the director provides them with a good script and guides them as they work together to create the film (i.e., learning). The director is in charge and manages the schedule. However, the quality of the film depends on the work of the actors and the director.

Diana, a primary teacher in the US, used three metaphors to describe her teaching role in different contexts (Tobin & Jakubowski, in press). Usually, she managed her class as *a police officer*, in some circumstances she was *a mother hen*, and on other occasions she was *an entertainer*. Her mode of behaviour (i.e., the metaphor she used to make sense of what she ought to do) depended on the context in which learning was to occur. Each conceptualization of her role as manager was associated with a discrete set of beliefs. Also, interviews

Her mode of behaviour ... depended on the context in which learning was to occur.

indicated how Diana used imagery to establish a mind-frame in which she could explain how the teaching of a former teacher influenced her own teaching.

Is it possible that images are used metaphorically to make sense of a new role that is to be adopted by a teacher? The metaphorical use of images would by-pass the use of language and guide actions unconsciously. For example, the decision to use a police officer as a metaphor for managing a classroom probably is not done consciously. Something in the context might result in the construction of an image associated with a role which is well understood (e.g., a police officer) and provide a basis for subsequent behaviour. Basing actions on images associated with another role is analogous to using a verbal metaphor to make sense of a new concept. The interview with Diana suggested that she based her teaching or images associated with her favourite teacher. It is apparent that she did not sit down and meticulously describe in words those behaviours that she would adapt and adopt. Rather, the association appears to have been more direct, involving reconstructed images of her former teacher. Similarly, Diana's decision to be an entertainer probably is associated with images of entertainers whom she has experienced and occasions when, in other roles, she has been entertaining.

The examples provided above do suggest that metaphors and images are used to make sense of teaching roles. However, many questions remain to be answered. How might teachers use information about images, metaphors, belief sets and role conceptualizations? What metaphors influence the way in which mathematics and science are taught? In what contexts do metaphors influence classroom practices? How are teacher and student practices constrained by the use of metaphors? Would the use of alternative metaphors result in desirable changes in classroom practices? Are the metaphors and images used to make sense of the salient roles compatible with one another?

TEACHER CHANGE

THE IDEA that metaphors could be used as a 'master switch' to change teachers' belief sets came in a study conducted in Australia (Tobin, Kahle & Fraser, 1990). One science teacher in this study, Peter, conceptualized his management role in terms of being *captain of the ship*. When the context was right, Peter became the captain of the ship and his students were regarded as the crew. How students and the teacher were expected to behave in activities was

defined in terms of the metaphor he used to understand management. The metaphor (and associated images) became a filter for formulating beliefs associated with management in the contexts in which it was considered relevant to manage the class in this way. Peter did not believe that it was always appropriate to be captain of the ship. Some contexts required different management styles. In such contexts, Peter believed that he should be *an entertainer*.

When Peter was entertaining the class, he was humorous, interactive and amenable to student noise and risque behaviour. Whole-class activities were appropriate for both metaphors. The captain of the ship gave orders and explanations to the entire crew and the entertainer performed to the whole audience. In both contexts, the teacher was in charge, just as the captain manages the ship and the entertainer manages the show.

What was so interesting in Peter's teaching was the quite distinct teaching style associated with each metaphor for managing student behaviour. As Peter switched metaphors, a great many variables changed as well. This finding suggests that teachers might be assisted to acquire new metaphors for specific teaching roles as a possible means of assisting them improve their classroom learning environment.

As Peter switched metaphors, a great many variables changed as well.

Further insights into the importance of metaphors in conceptualizing teaching roles were obtained in a study of Sarah in the US (Tobin & Ulerick, 1989). When the study commenced, Sarah had been teaching two classes for one semester and patterns of behaviour and interaction were well established. Sarah had major problems with classroom management. Although Sarah believed that her role as facilitator ought to have been regarded as having highest priority, her inability to manage her classes effectively necessitated that greater priority be given to her management role. The main metaphor Sarah used to conceptualize management was *teacher as comedian*. Teaching behaviours associated with the metaphor seemed to elicit aggressive student behaviour; students took advantage of Sarah, did not cooperate with her, and the learning environments in her classes were not conducive to learning.

Sarah described her role as facilitator of learning in terms of three metaphors, the *comedian*, the *miser* and the *saintly facilitator*. However, Sarah acknowledged that all three metaphors did not influence how she taught. The saintly facilitator was a role that Sarah only applied to her ideal class. When she taught, Sarah was the comedian and, when that was not successful, she became the miser. The essence of the three roles is captured in the following excerpts from Sarah's description of her facilitating roles:

> Saintly Facilitator: *In this role, I am in the classroom to help people learn. Students are individuals and must be treated as such. I would like to work one-on-one with students more often. I imagine them inviting me into their 'personal space' as a trusted friend and guide.*
>
> Comedian: *The comedian believes that students will be captivated by charm, humour and well-organized presentations, which they will find enjoyable and easy to learn. Students might get restless in such a class, but hardly ever would be bored or rebellious.*
>
> Miser: *I am a facilitator with limits on my time and energy for the job. I will do only so much. I weigh the results against the hassle. I must place high value on my life outside the classroom to justify reducing my efforts in the classroom.*

The excerpts indicate that Sarah viewed her facilitator role in terms of being a popular comedian. Although she had some beliefs based on what she had learned in her studies (i.e., the saintly facilitator), she acknowledged that these did not influence the way in which she planned and implemented the curriculum. The context was never right to be able to teach that way. Further, she believed that she should not expend too much effort in preparing for her classes. This belief might have developed, in Sarah's view, because students were not cooperating with her and had become unteachable.

Sarah's beliefs about assessment were associated with a metaphor of rewards and punishment. She seemed to worry about assessment and focused on failure. Certainly, the students in her classes were not as successful as she wanted, and Sarah was aware of the problems associated with such a high number of failures. Sarah had problems, wanted to make changes and recognized that she needed assistance. Her journal entries and interviews indicated that she was reflecting on practice and did not like what she saw. Further, she knew that she could not solve her problems without assistance from others.

Sarah received assistance from a team of educational researchers. Discussions with team members focused on constructivism (von Glasersfeld, 1987) and Sarah's teaching was focused on students having opportunities to learn. Constructivism highlights the importance of what students know and the manner in which knowledge is constructed and applied. Knowledge does not reside outside the students. A constructivist perspective gives importance to learners observing, reflecting on their observations, collaborating with peers, negotiating meaning and arriving at consensus. The sense-making process is regarded as the vital part of learning as learners negotiate through processes such as describing, clarifying, elaborating, justifying, evaluating and conceding. Sarah embraced constructivism, which was readily incorporated into her saintly facilitator role.

A constructivist perspective gives importance to learners observing, reflecting on their observations, collaborating with peers, negotiating meaning and arriving at consensus.

Sarah decided to reconceptualize her role as manager in terms of being a *social director*. Her application of this role to teaching was metaphorical and resulted in rejection of many of her previous beliefs about managing a class. Her social director metaphor was associated with beliefs that were compatible with constructivism. According to the metaphor, the teacher invites students to the party of learning. Students decide whether to come or not, and the teacher's role is to create opportunities for learning. If students decide not to accept the invitation, the teacher has the responsibility to make the invitation more attractive. Only two rules applied: guests (i.e., students) should be courteous to their host (i.e., the teacher) and to one another; and guests should not disrupt the fun (i.e., learning) of others. Guests who violated these rules would be invited to leave the party. Student misbehaviour, which previously was widespread, almost disappeared overnight. With management less of an issue, Sarah pursued her roles as facilitator of learning and assessor of students. Numerous changes occurred in teacher and student behaviour.

Although disruptive behaviour diminished considerably, many students

exhibited latent hostility. A change that produced almost immediate results grew from the suggestion that Sarah might view the role of assessment in terms of providing a window into the student's mind. An assessment would allow the teacher to see what a student knew or permit a student to show what he or she had learned. During the next day on which science was taught, there were significant changes. Over a short period of time, the learning environment improved appreciably. Sarah realized that so many students need not fail science, she changed her procedure for assigning grades, she communicated the new system to her classes, and she endeavoured to create an expectation of anticipated success in science. Students who had regarded her assessment procedures as unreasonable responded with enthusiasm to the new approach to assessment.

WHAT WE LEARNED FROM THESE STUDIES

IDENTIFICATION OF salient teaching roles, and the metaphors used to conceptualize them, offers the possibility of changing what teachers do in the classroom. The metaphor used to make sense of a role is a master switch for associated belief sets of teachers. If a switch is thrown (i.e., the metaphor is changed), a host of changes follow (i.e., as new beliefs are considered relevant to the role) in the classroom. Reconceptualizing a role in terms of a new metaphor appears to switch an entirely different set of beliefs into operation. Organizing roles, metaphors and belief sets in this way highlights the importance of the teacher's framing of the context in determining whether or not particular actions are taken in the classroom.

It is possible for teachers to have a variety of context-specific conceptualizations for a given role. Whether or not specific teacher beliefs will influence classroom practices depends on the perceived relevance or utility of the role to the circumstances that apply in the classroom. The teacher's framing of the context in which learning is to occur is an important factor in determining what is done in the classroom. For example, a teacher might believe that, in certain circumstances, it is desirable to be a gardener (i.e., a teacher) nourishing the seedlings (i.e., the children). However, in the circumstances which prevail on a particular day, a teacher might decide that it is more appropriate to be a police officer.

Identification of salient teaching roles, and the metaphors used to conceptualize them, offers the possibility of changing what teachers do in the classroom.

The metaphors used to make sense of the roles and belief sets associated with particular actions are important factors that might be productive foci for reflection. Teachers can identify the salient metaphors for specific teaching roles and consider whether or not alternatives would lead to improvements in the classroom. If teachers decide to alter the metaphors which they use to understand particular roles, beliefs previously associated with the role might be perceived to be no longer relevant to that role. Beliefs consistent with the new metaphor then can be considered relevant and influence what teachers do as they plan and implement the curriculum.

The images which teachers use to conceptualize their teaching roles also are important in constraining teacher actions. If you ask a teacher about the best teacher that they have had, they will reconstruct an image to which they can assign language. The image can be

reconstructed when necessary and can guide subsequent actions. Images, however, have metaphors, beliefs and epistemologies embedded within them. Being guided by an image represents a potential explanation for teachers knowing intuitively how to act in certain situations.

QUESTIONS FOR TEACHERS TO CONSIDER

ANALYZING TEACHING and learning in terms of salient roles, metaphors, images and associated beliefs appeals as a basis for changing your own teaching. Relevant questions include:

- What are the most salient roles that apply when you teach?
- What images and metaphors are associated with each of these roles?
- How do the images change for a given role when the context changes?
- Are the beliefs associated with each of your roles consistent with those that are associated with other roles?
- In what ways are the images and metaphors used to make sense of a specific role beneficial? Do these metaphors and images lead to situations that are sometimes problematic?
- Identify alternative metaphors and images for each of the roles that are important in your teaching. How might these metaphors and images lead to improvements in the classroom? What limitations do these metaphors and images have?
- Analyze the teaching of a colleague in terms of salient roles, metaphors, images and belief sets. Compare your self analysis with the analysis of the colleague. Discuss what you have found with your colleague.
- Analyze the metaphors and images used by students in your class as they explain the solution to a problem in mathematics or science. Try to understand how the metaphor or image assisted them to solve the problem or prevented them from obtaining a plausible solution.

The abcve sample questions and ideas to pursue are based on constructivism, which invites questions about the sense-making process. As mathematics and science teachers, teacher educators and researchers, we have not focused sufficiently on this important aspect of learning. Asking questions about roles, metaphors, images and belief sets has opened doors and revealed new apprcaches to what we do.

REFERENCES

Tobin, K. & Espinet, M. (1989). Impediments to change: An application of peer coaching in high school science. *Journal of Research in Science Teaching, 26,* 105-120.

Tobin, K. & Gallagher, J. J. (1987). What happens in high school science classrooms? *Journal of Curriculum Studies, 19,* 549-560.

Tobin, K. & Jakubowski, E. (in press). The cognitive requisites for improving the performance of elementary mathematics and science teaching. In E.W. Ross, J.W. Cornett and G. McCutcheon (Eds.), *Teacher personal theorizing: Issues, problems, and implications.* Columbia, NY: Teachers College Press.

Tobin, K., Kahle, J.B. & Fraser, B.J. (Eds.) (1990). *Windows into science classrooms: Problems associated with higher-level cognitive learning.* London: Falmer Press.

Tobin, K. & Ulerick, S.J. (March, 1989). An interpretation of high school science teaching based on metaphors and beliefs for specific roles. Paper presented at annual meeting of American Educational Research Association, San Francisco.

von Glasersfeld, E. (1987). *The construction of knowledge.* Seaside, CA: Systems Inquiry Series, Intersystems Publication.

Professor Kenneth Tobin is Coordinator of Science Education and Head of the Department of Curriculum and Instruction at Florida State University, Tallahassee, Florida 32306, USA. Previously he was Senior Lecturer in science education at Curtin University.

ISSN 1033-3738

FURTHER READING ABOUT METAPHORS AND IMAGES

Further information about metaphors and images for teaching is contained in the following monograph, which reports an Australian study of higher-level cognitive learning:

Barriers to Learning Science with Understanding (By Kenneth Tobin, Barry Fraser & Leonie Rennie) Cost: $10

A copy of this monograph may be obtained by sending a cheque (payable to "Key Centre for School Science and Mathematics") or purchase order for $10 to the Key Centre at the address at the bottom of this page.

EXTRA COPIES OF *WHAT RESEARCH SAYS*

The present publication is part of the *What Research Says to the Science and Mathematics Teacher* series. The issues available to date in this series are:

No. 1: Exemplary Science and Mathematics Teachers (*Barry J. Fraser and Kenneth Tobin*)
No. 2: Assessing and Improving Classroom Environment (*Barry J. Fraser*)
No. 3: Scientific Diagrams: How Well Can Students Read Them? (*Richard K. Lowe*)
No. 4: Images of Scientists: Gender Issues in Science Classrooms (*Jane Butler Kahle*)
No. 5: Metaphors and Images in Teaching (*Kenneth Tobin*)

Any document in this series may be purchased for $1. For orders of less than six copies, there is an additional handling charge of $1. Discounts are available for orders of more than 12 copies. Send cheques (payable to the "Key Centre for School Science and Mathematics") or purchase orders to the Key Centre at the address at the bottom of this page.

INSTITUTE ON TEACHING FOR UNDERSTANDING LED BY JAMES GALLAGHER

During the week of 1-5 October 1990, Professor James Gallagher of Michigan State University, USA, will lead a unique professional development institute on science and mathematics for understanding and application at Curtin University in Perth. A certificate of attendance will be issued to all participants. If desired, this institute can be taken for credit towards the postgraduate qualifications described below by completing assignments in the external study mode after the institute. A brochure containing further information about this and other institutes may be requested from the Key Centre at the address shown below.

POSTGRADUATE STUDIES IN SCIENCE AND MATHEMATICS EDUCATION

Currently, approximately 100 practising science and mathematics teachers are undertaking postgraduate studies at Curtin University. The Postgraduate Diploma in Science/Mathematics Education, Master of Applied Science (Science/Mathematics Education), either by thesis or by coursework plus project, and the Doctor of Philosophy provide outstanding professional development opportunities for practising science and mathematics teachers. In addition to units in science and mathematics education, the programs include specially-designed units for upgrading teachers' content knowledge in science and mathematics. A new unit on gender issues in science/mathematics education is available. Because of their availability for external as well as internal study, these programs are readily accessible to all teachers in Australia. There are opportunities for gaining credit for attending residential institutes at Curtin during school holidays. For further information, a course brochure can be requested from the Key Centre at the address shown on the bottom of this page.

This document was produced by the Key Centre for Teaching and Research in School Science and Mathematics (Particularly for Women) at Curtin University of Technology. This Key Centre, which is funded by the Commonwealth Government, recognizes and builds upon the exceptional strengths in science and mathematics education already existing at Curtin. The Key Centre sponsors extensive educational research, publication and teacher professional development programs. It aims to improve the quality of, and participation in, school science and mathematics, especially among girls. The Key Centre sponsors visits from eminent overseas scholars who assist in its research and teacher professional development activities. The Key Centre's address is

Key Centre for School Science and Mathematics
Curtin University of Technology
GPO Box U1987
Perth, Western Australia 6001
(Telephone: 09 351 7896 Fax 09 351 2503)

BJF-3-TT-30/4/90
33346-5-90