Cognitive-behavioral Approaches to Community Safety Education

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In discussing the tradition of agricultural health and safety education efforts, many researchers have noted the relative ineffectiveness of such approaches for changing farmers' behavior.

> "…educational programs for delivering this [farm health and safety] knowledge are low in number and often of questionable effect." (Agriculture at Risk ,1989. p. 5)

Murphy (1992) provides a detailed examination of this problem and its prior relevant research in Chapters 7 and 8 of his Safety and Health for Production Agriculture text.

> "It often seems as though relatively little has been accomplished through the years with safety and health education in production agriculture. … the nature of production agriculture, and current social, political, and economic realities, suggest that safety and health education will remain a favored methodology for the foreseeable future." Murphy, 1992, p. 144.)

He also notes that the few federal regulations that apply to farm health and safety have not been effective for a variety of reasons. He notes that 85% to 90% of farms are family-owned and operated and that family members who work on these farms are exempt from the regulations. Even laws that do apply to farm families and rural residents (like the appropriate use of slow moving vehicle signs) are ignored and rarely enforced. Murphy also notes that

> 'The similarity between the tractor and machinery portions of the OSHA regulations directed toward required behavior and traditional safety educational suggestions is unmistakable. The regulations attempt to direct behavior in the same generalizable fashion that traditional safety and health education programs do. … the regulations are directing tractor drivers to 'stay off steep slopes too steep for safe operation' … to 'not carry extra riders'… to 'keep all guards in place.' These instructions ignore individual working contingencies that influence actual behavior by individuals in specific situations." (p. 167)

Murphy continues with

> "…many production agriculture safety and health regulations directed toward individual behavior are nothing more than educational behavioral guidelines." (p. 167)

Murphy also calls attention to a question that is the subject of this paper.

> "Attention, then, must be focused on the question of how safety and health education might do a better job for production agriculture." (pp. 144-145)

Murphy presents an excellent historical review of safety education efforts. He also reviews social psychology studies and concepts of voluntary attitude, belief, and behavior change; persuasive communication theory and methods; the societal origins and value of health and safety regulations; and methods for gaining target population compliance with safety rules and practices. Murphy's summary of these and related issues is valuable information for those involved in promoting agricultural health and safety interventions.

In the course of his discussion, Murphy mentions two points that are very important. He says, as noted above, that much health and safety education ignores the "working contingencies" that in large part prescribe why farmers do or do not follow safety advice and rules. Elsewhere he notes that the role of well established habits in maintaining existing behaviors and preventing the adoption of new behaviors has been ignored. These two observations are related to two major theories of how people learn. A third major theory of learning underlies the social psychology theories that Murphy reviews. This paper examines farm safety and health education efforts from these three learning theory perspectives.

Three Historical Perspectives of Learning and Instruction

During the 20th century three major theories dominated thinking and practice with respect to how people learn and how to design instruction (Bereiter, 1994; Mayer, 1996). These were (a) the behaviorists "responses strengthening" approach and the development of habits, (b) learning as acquiring and organizing information by which to construct knowledge to direct behavior and solve problems (called constructivism), and (c) knowledge, attitudes and problem solving strategies acquired through the activities of people working together on the ordinary and meaningful tasks important to them in their daily lives and work (called socioculturalism).

Behaviorism and Habits

From the 1900s to the 1950s the behaviorists response-strengthening paradigm prevailed. This approach came to be known as the A à B à C model of behavior (Skinner, 1953). Antecedent conditions (A) are things a person can see, hear, feel, and remember that cue a particular behavior in a certain situation. Behaviors (B) are the actions that a person exhibits in the presence of antecedent conditions. Consequences (C) are the outcomes or effects of the person's actions or behaviors. Behaviors that frequently lead to desirable outcomes (consequences) are said to be positively reinforced (rewarded) and become habits. Behaviors that are not reinforced (rewarded) by desirable outcomes tend to disappear (be extinguished). Under this model behaviors that are reinforced (rewarded) by relatively immediate desirable outcomes compete with behaviors that may sometime in the distant future provide desirable outcomes (rewards) (Cole, 1995; Mayer, 1992; 1996). For example, I knew a company mine safety and health inspector who was 40 pounds overweight with early stage heart disease. He was advised by his doctor to change his dietary and exercise habits. He wanted to lose weight, exercise, be healthy and live a long life. These were the long-term reinforcers for his adoption of healthy life style behaviors. But every day at work he continued to drink large amounts of strong coffee and eat 10 to 12 donuts. The coffee and donuts were free, tasted good, and made him feel better when he

was stressed. These immediate reinforcers and his heavy work schedule competed against his healthy diet and exercise behaviors. Unable to change his life style behaviors, in a few years his cardiovascular disease worsened, he became disabled, and died prematurely. It is important to point out that fear of the severe but relatively remote punishment of serious illness and premature death did not deter this man's dangerous life style behaviors. Why is this? Because punishment works well only when it is relatively immediate, inescapable, and severe. That is why when the elevators are backed up and people are in a hurry to get to the lobby of a hotel they do not jump from the third floor balcony.

Although generally not recognized, safety behaviors like having a ROPS and a seat belt installed on a tractor and then always wearing the seat belt are maintained not by fear of punishing overturn injuries. The probability of an overturn and an injury is small and not certain. Maintaining consistence compliance with a safety behavior like always driving ROPS-equipped tractors and always wearing a seat belt requires frequent positive reinforcers. Recently, as part of a larger study, we interviewed 59 farmers who retrofitted their tractors with ROPS and asked them why they did so. They told us that having a ROPS on their tractor made them feel safer every time they drove, that they knew they were protecting their family and farm, that they could look forward with more assurance of seeing their children grow up, and that they feel greater peace of mind when other members of their family drive the tractor (Cole et al, 2001). These are the immediate positive reinforcers that maintain the use of ROPS and seat belts. They are very similar to the immediate positive reinforcers that maintain other health and safety behaviors like flossing teeth, exercising regularly, and eating moderate amounts of healthy foods.

Competition among immediate and delayed reinforcers also is apparent when a farmer who wants to work safely and avoid machinery entanglement injuries continues to operate a machine with missing shields. The farmer saves his precious time, effort, and money (all three immediate reinforcers) by delaying the installation of the shields. Not replacing the shields also has been rewarded in the past by working without an injury. The farmer's reinforcement history teaches him it is likely he will to continue to be rewarded for not replacing the shields and that he is also unlikely to be punished by an injury on a short-term basis in the future.

Although it is very useful for understanding aspects of behavior, the ABC model of behavior gives little credence to attitudes, beliefs, and intentions as influences on behavior. Rather, the habitual learned behaviors are seen as causing specific expressed beliefs and attitudes. The behavioral model is still widely used in mine health and safety as well in many other industrial settings with highly structured and supervised work settings (Cole, 1995). Structuring learning situations to provide positive reinforcement for desired behaviors is effective in almost all situations. The behavioral approach also is useful for understanding how safe and unsafe work practices are learned and become habitual. However, in all settings the A à Bà C model has limitations related to the influences of human thinking and social interaction as these apply to both individual and group behavior. The model is also far less operable in the more open, self-directed situations that describe the typical family farm operation.

Information Processing and Constructing Meaning

A second model of learning and instruction became widely influential during the 1960s through the 1990s. The initial work in this area was based on an electronic computer metaphor. The human mind was seen as being like a computer in terms of taking in information, organizing information and placing it in memory, using the information to make decisions, and constantly upgrading organized stored information in terms of ongoing experience. Soon this more literal view of information processing was replaced with a more cognitive and less mechanistic model. Information taken in by individuals was seen as being assimilated to coherent and organized knowledge structures (called schema or concept systems). Persons involved in processing and interpreting information were seen as "making an effort after meaning." Under this perspective, the learner is viewed as selecting information from the environment, organizing the information within existing knowledge and experience, and constructing meaningful and coherent mental models (representations of the world). It is through the mental models that strategic plans are developed that direct actions toward desired goals and overcome barriers to reaching those goals (Bower & Morrow, 1990; Gentner & Stevens, 1983; Mayer, 1992; 1996).

Under the constructivism approach instruction is concerned with presenting well-organized information to people in ways that they can easily understand its relevance to their lives and goals. People can then assimilate this information with their existing knowledge. In the case of health and safety education, this involves acquiring information to improve hazard recognition as well as the adoption of proactive health and safety practices. Much of the traditional agricultural health and safety training efforts reviewed by Murphy (1992) involves abstracting information derived from epidemiological studies of farm work hazards and injuries and identifying effective environmental and behavioral methods for their prevention. As Murphy notes, this information is collected and codified as sets of behavioral guides and rules that comprise the core of both the educational efforts and regulatory practices.

In Chapter 7 of his book, Murphy (1992) describes the characteristics of effective safety messages; voluntary behavior change and social psychology; causal attribution theory; the learning and interactions of attitudes, beliefs, behavioral intentions and behaviors; and persuasive communications. He integrates much of this research and its implications for agricultural health and safety messages and instruction with the theory of reasoned action described by Fishbein and Azen (1975) depicted below in Figure 1. Beliefs are knowledge about objects, persons, events, as well as knowledge about how others in one's referent group(s) expect one to behave or act in specific situations (subjective norms). Beliefs influence both attitudes about performing a behavior and motivations to do so. Attitudes are evaluative judgements about the worth or appropriateness of actions, objects, plans etc. A person's attitude toward engaging in a particular behavior is also mediated or influenced by what he or she perceives his or her normative social groups think about the behavior. As an individual processes all this affective and cognitive information, he or she develops intentions to act or not act. According to research by Fishbein and Ajzen and many others, behavioral intentions predict behavior much more effectively than do attitudes alone.
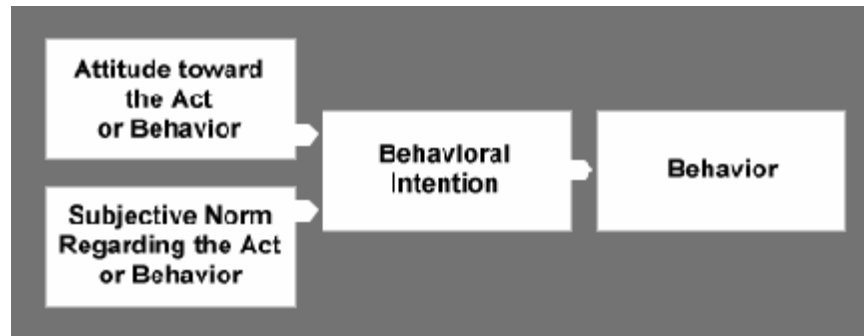
Figure 1: The Fishbein and Ajzen Theory of Reasoned Action model

Another newer conceptualization called the "extended parallel process model" (Witte 1992, 1994) deals with the design of safety messages and their impact on behavior. This model conceptualizes people's reaction to a safety message, particularly messages called fear appeals that describe a loss (injury, death, economic) that could result from not adopting a safety behavior. The model hypothesizes that when people hear or see such a message that is relevant to their circumstances, they will respond by either accepting the message and acting to control the danger or by rejecting the message to control (subdue) their fear of the event described in the message. Whether or not a fear appeal message is rejected or accepted depends on two other categories.

The first of these categories is the person's perceived threat of the event described (for example a tractor overturn). Perceived threat has two parts, the degree to which the person feels he or she is susceptible to the threat, and the perceived severity of the threat. A farmer might perceive he is not susceptible to an overturn because his land is flat. That same farmer might recognize that an overturn on a tractor without a ROPS can result in severe injury or death. Although he knows the harmful consequences of an overturn, the farmer may decide not to invest in a ROPS and seat belt because he thinks he is unlikely to experience an overturn.

The other major part of the model concerns the farmer's self efficacy and his or her belief in the response efficacy. Self efficacy is defined by Bandura (1989) as one's belief in the ability to exhibit agency and control over events to achieve desired outcomes. Response efficacy is the person's belief in the worth of whatever is being recommended as a safety procedure or device. For example, a farmer might hear or see a safety message in newspaper or radio public service announcement about a local farmer who overturned a tractor without a ROPS and as a result was permanently disabled. Then message might explain how a ROPS and seat belt could have prevented this terrible event. If the farmer is to accept this message and control the risk of costly overturn injuries by installing a ROPS on a tractor, he or she must first believe in the efficacy of ROPS and seat belts, that they are in fact very effective in reducing injury during overturns. Second, the farmer must also believe that it is within his or her capability to find, pay for, and have a ROPS installed on the tractor. A farmer may feel susceptible to an overturn, and understand the severity of an injury from such an event. But he may also feel that he cannot find a ROPS for his tractor or afford to expend the dollars to purchase the ROPS and have it installed. In this case the safety message will be rejected as a defensive reaction to control the farmer's fear.

It is apparent that all of these social psychology models are also information processing

approaches. They involve individuals taking in information, assimilating it with existing knowledge and experience, and attempting to make meaning from the information. The knowledge acquired may or may not influence the person's behavior depending upon many factors. Some factors are internal and related to established habits and attitudes of the individual. Others factors are related to the influence of persons in the social referent groups to which the person belongs. Still other factors are related to the person's resources and capabilities that are necessary to respond. Murphy (1992) makes an insightful statement about these social psychology theories.

> "Social psychologists and safety and health professionals readily acknowledge that it is difficult at best for one person to persuade another person to change attitudes and behavior." (p. 152)

On the next page he comments that many of the social psychology principles reviewed were abstracted from controlled laboratory studies, often with readily available college student subject pools on contrived problems not representative of the complex problems and convoluted dynamics of the real world. He goes on to say

> "…controlled laboratory studies involve a number of attributes, circumstances, and situations that are different from the real-world environment. Thus, laboratory experiments are not as generalizable to real-world situations as one might assume." (p. 153).

There is another point not stated in Murphy's book or in other publications that deal with promoting agricultural safety and health. The point concerns assumptions about the question, "Where do safety beliefs, attitudes, knowledge, behavior and strategies reside?" There are three answers to this question. The behaviorists say that safety attitudes, knowledge, and behaviors reside in individuals' habitual behaviors, habits that have been selected and reinforced by environmental factors. The information theorists say that individual learners take in information from their environment, assimilate this information with existing habits, organized knowledge structures, beliefs, attitudes, motives, and action strategies in the attempt to make coherent meaning about life activities. The socioculturalists have a very different answer. They say that safety knowledge, attitudes, strategies and intelligence do not reside in the heads of individuals, but instead in the communal everyday practices of "just plain folks" engaged in cooperative social efforts in which each member has a legitimate interest and role (Gheradi & Nicolini, 2000; Gheradi, Nicolini, & Odella, 1998; Lave & Wenger, 1994).

Socioculturalism and Situated Cognition in a Culture of Learning

Sociolculturalism began to become an established learning theory in the United States only in the mid to late 1970s (Bereiter, 1994; Brown, Collins, & Duguid, 1989; Bruner, 1990; Cole, 1997; Freire, 1990; Lave & Wenger, 1994; Resnick, 1987). This conception of learning grew from studies of how people learn rapidly and effectively the many complex ideas and skills related to the practice of important everyday life activities when they are part of a social group working toward common goals. It also called attention to how ineffective formal instruction is for

teaching these same outcomes. The sociocultural view of learning holds that the knowledge basic to the performance of complex tasks, including health and safety behavior, is the product of an ongoing interaction with the work at hand, the tools used to perform this work, and negotiations among members of the group. As such the beliefs, attitudes, knowledge and skill to perform work well and safely do not reside in the heads of individuals, but are distributed across the tools and individuals that comprise the social group. This view is neither widely appreciated nor embraced by many persons who plan and conduct safety training (Wallerstein, 1992; Wallerstein & Bernstein, 1988; Wallerstein & Wenger, 1992). Under this view safety education becomes a process of helping to empower workers to better understand the constraints and plights under which they work and to better identify and use resources and knowledge available to the social group. The goal is to help the group to become more proactive in improving the health and safety of their community of workers.

Wallerstein (1992) reviews a long history of social epidemiology that suggests that when people become more empowered socially and economically, they also become healthier and suffer fewer illnesses and injuries, especially those related to their occupations. She also notes that increased self-efficacy (Bandura, 1989) leads to a stronger sense of personal agency in self-direction. This not only improves the general quality of life, but also results in increased proactive identification and elimination of hazards that result in occupational injuries. This effort cannot be achieved on an individual basis, but requires social problem solving by communities of workers. Wallerstein and Wenger (1992) state:

> "Educators can best support worker actions by working within their organizations to develop institutional structures which can respond to issues identified..." (p. 621).

Through this social problem solving, workers and managers are empowered to recognize, eliminate, or control specific occupational hazards that threaten their well being (Wallerstein, 1992; Wallerstein & Bernstein, 1988; Wallerstein & Wenger, 1992).

More recently, in writing about organizational learning in communities of practice, Gherardi and Nicolini (2000) state that safety knowledge within a social group like a family farm operation or a factory is not a matter of individuals' mental knowledge, but is a form of organizational expertise that is learned from the members' interactions with each other and their work environment (p. 10). These authors then say
"It follows that efforts to increase commitment to organizational safety should be oriented from within communities of practice by actions that personally involve their members and make safety a part of their professionalism, not an obligation imposed from outside." (p.16)

Another key feature of sociocultural learning theory is the role of narrative in the construction of meaning, the formation of beliefs and attitudes and the prescribing of behavior. Vitz (1990) points out that for matters of practical choice and actions, stories are better guides than rules. Rules are generalizations abstracted from many specific contexts and often have little coherent meaning for the individuals to whom they are directed. On the other hand, stories reveal meanings and values in the context in which they are told. As such these parables tend to be understood, remembered and to influence decisions including safety behavior (Cole, 1997, Cole, Vaught, Wiehagen et al., 1998). Gagne (1984) while discussing the various domains of learning

also points out one of the failures in trying to teach attitudes by direct instruction. He notes that it is often very effective to simply tell someone how to perform a task like using a library card catalog or a computer to locate a particular book. However, when applied to teaching attitudes, Gagne notes that direct instruction is almost always ineffective or counter productive. A person does not change his or her attitude by being told to do so or how to do so. Gagne says that attitudes are best learned by the observation of a human model's behavior, an indirect method of instruction. In his social learning theory research, Bandura points out that a model is any pattern that can be observed and used to direct thinking and feeling. One type of model that is highly effective for teaching beliefs and attitudes are stories. The stories or culture tales of a social group play a large role in the enculturation of its members' attitudes, beliefs, and practices.

The conceptual model depicted in Figure 2 is described in detail elsewhere (Cole, 1997). Here it is sufficient to point out how this narrative model integrates behavioristic, constructivist, and sociocultural views of learning. Traditional behavioristic theory deals primarily with the two right hand boxes in the model, behavior and consequences. Behaviorists lumped all the items in the two boxes on the left-hand side of the model into "antecedent conditions." These antecedent conditions were usually conceptualized in limited ways, mainly as drives to reduce unmet needs. Behaviors that resulted in the reduction of these drives were said to be reinforcing. This approach was called deficit motivation theory because animals and people were viewed as being active and learning primarily to reduce unmet needs (hunger, thirst, sex, social acceptance, recognition, etc.). The theory postulates that behaviors that are effective in meeting those needs are reinforced by drive reduction. The reinforced behaviors then become learned habits.

Culture Cognition Conduct Consequences

Figure 2: An integrative narrative model of behaviorism, constructivism, and socioculturalism (From Cole, 1997)

Cognitive constructivist theory recognized the validity of the behaviorist theory of learning but also recognized that behavior is influenced by cognitions and social interactions having to do with the items listed in the "cognition" box in Figure 2. Furthermore, constructivist theory states that when people act on the environment and attend to the consequences of their actions they do more than only respond to stimulus events and needs-drive motivators. They also search for patterns and meaning among their actions, the context of the actions, and the consequences of those actions. From these experiences, and from social interaction and observation of others, individuals construct the organized attitudes, beliefs, knowledge and other items listed in the "cognition" box. These become their internalized representations of the world, the mental models by which people perceive, believe, know, evaluate, and act (Bower & Marrow, 1990; Bruner, 1990; Cole, 1997; Gentner & Stevens, 1983; Howard, 1991; Sarbin, 1986)

The socioculturalists accept the validity and utility of both the behaviorist and the constructivist viewpoints. They agree that these are ways of understanding the actions of people engaged in the multiple practices of life and work. But they differ in that they see knowledge and practice as being much more a shared cultural experience than simply "in the head" accumulation of information and organized knowledge by individuals. They recognize the social and cultural

properties of meaning making, intelligence, and practices of a group is different from and greater than any one individual's mental models and behavioral capabilities. This view is very similar those of Max Wertheimer, the founder of Gestalt psychology as can be seen from reading his 1924 address to the Kant Society in Berlin (Wertheimer, 1936).

A Case Example

Let us consider an actual case. A farmer owns two tractors, both without Rollover Protective Structures (ROPS). He and his wife have worked their hilly 600-acre farm for 25 years without an overturn. He knows three people in his county who died in tractor overturns and four others who survived overturns on tractors without ROPS, one who never fully recovered from his injuries. He has seen many stories and photographs in newspapers and farm magazines about fatal tractor overturns. Extension agents and equipment dealers have encouraged him to put ROPS on his tractors to protect himself and his family. He has the money to do so but says, "Until I get a bigger and newer tractor, I'm not going to worry about getting a ROPS. And when I get a newer tractor it won't be for the ROPS!" How can the farmer's statement be explained? The behavioral model is useful for describing the farmer's habitual behaviors of driving tractors without ROPS and his reluctance to install ROPS on his tractors. How were these behaviors learned?

This farmer and his wife drove tractors an average of three times a day, 20 days a month for a total of 25 years. During these 36,000 tractor-driving events they never had an overturn. Occasionally they encountered tricky situations where their caution and driving skills prevented an overturn. The consistent positive outcomes (driving without an overturn) reinforced and improved their skilled tractor driving behaviors (Skinner, 1953) and also developed strong self-efficacy beliefs that they were capable of preventing tractor overturns (Bandura, 1989). This complex set of memories, skills, and beliefs are antecedent conditions shaped the farmer's attitude expressed in his statement, "ROPS are a waste of money" as well as his continued behavior of driving of tractors without ROPS. Attitudes consist of feelings (emotions), knowledge, and patterns of thought that influence both beliefs and actions (Gagne, 1984). Replacing habitual risky behaviors with safe behavior requires changes in attitudes as well as knowledge.

During his 26th year of farming the farmer overturns a tractor and becomes a paraplegic. Subsequently, the farmer and his wife install ROPS on all their tractors to protect her and other members of the family. While a life lesson like this can be effective in changing dangerous attitudes and behavior, the injuries can be so severe that they remove a person from a situation before he or she has an opportunity to replace risky behaviors with safe behaviors. How, then, can strongly ingrained risky attitudes and behaviors be changed prior to an injury event?

Knowledge about tractor overturn risks, injuries, and consequences as well as the effectiveness of ROPS and seat belts for preventing these injuries, is necessary if farmers are to adopt ROPS. This knowledge can be transmitted directly by telling or showing farmers what they need to know. However, such direct instruction is ineffective for teaching attitudes (Gagne, 1984). To influence behavior, knowledge must be supported by attitudes that help the individual perceive the relevance of that knowledge to his or her daily life. Otherwise the knowledge remains inert and untapped.

Attitudes are learned primarily though models of other people's behavior and as internalized

stories about these human models (Bandura, 1989; Bruner, 1990; Cole, 1997; Gagne, 1984; Sarbin, 1986). Some of the models are real people with whom we interact directly; people whom we respect, observe, and strive to imitate. Other models are people with whom we have no direct interaction, but whose stories we hear about and identify with. Collectively the stories about these models become internalized as mental models that guide our plans, decisions, and actions as well as our understanding of our own and others' conduct. These stories have been called culture tales (Howard, 1991) and stories to live by (Cole, 1997).

It is helpful to ask, "What stories and culture tales may have contributed to this farmer's continued operation of a tractor without a ROPS and seat belt on his hilly farm?" The farmer read stories in the local papers about other farmers' injury and death during overturns. If the stories were typical of those in rural newspapers they probably described these events as "unfortunate," "acts of God," "unavoidable," and made no mention that a highly effective protective device (a ROPS and a seat belt) can prevent nearly all of these deaths. A set of pervasive culture tales in many farm communities is that overturns just happen, that often times they are deadly, but sometimes a person can jump free and escape injury, and that by being skilled and careful a farmer can avoid overturns.

Similar community stories about the death of child second riders on tractors are common. These culture tales usually describe how much the child loved to ride on the tractor with his grandfather, how his daddy had done so as a child, and the valuable lessons the father had learned from this practice. The child's time riding on the tractor with his grandfather is often depicted as "quality time" and "necessary" to the child's proper development and learning to be a farmer including learning safe tractor driving skills. The continuation of this family tradition is described as a core enculturation practice that is cherished and has many benefits for both the child and adult. The one-time event in which the child falls from the tractor, is run over and killed is depicted as a "freak accident," "bad luck," and something for which no one is responsible.

These culture tales make it clear that the knowledge and meaning made from overturning a tractor and being hurt or killed, or from riding along on a tractor and falling off and being run over, is a shared community meaning not only or mainly an individual representation. It is also clear that in order to correct these problems members of the community must confront, negotiate, think, talk about and create new meanings and culture tales for these types of events. Outsiders admonishing farm family and community members for these views and practices, or blaming them for being uncaring and stupid, is ineffective and counter productive for changing culture tales that are in need of "story repair."

Conclusion

Replacing habitual risky behaviors with safe work practices requires changes in both knowledge and attitudes. While simply showing or telling someone what they need to know can transmit knowledge, direct instruction is ineffective for changing attitudes. Attitudes are changed primarily through our interactions with human models and parables. Furthermore, changing attitudes of the members of a practice community is best approached from within that community. If persons from outside that community wish to assist in the change they must become what Lave and Wenger call legitimate peripheral participants in the practice activities of that community.

Some recent farm safety and health intervention projects are a step in this direction. The Simple Solutions: Ergonomics for Farm Workers projects (Baron, Estill, Steege, Lalich, 2001) were part of the NIOSH Community Partners for Healthy Farming intervention activities. These projects involved teams of researchers listening to and working with farm community members. The workers engaged in their everyday practices of picking, washing and bagging vegetables or making cuttings from woody plants. As they did so the researchers involved interacted with the farm workers. These collaborative dialogs resulted in new ways of thinking and new working practices that reduce risk of injury, improved safety and health, and increased production.

References

Bandura, A. (1989). Human agency in social cognitive theory. American Psychologist, 44, 1175-1184.

Baron, S., Estill, C.F., Steege, A., Lilich, N. (Eds.) (2001). Simple solutions: Ergonomics for farm workers. (DHHS (NIOSH) Publication No. 3001-111). Washington, DC: U.S. Government Printing Office.

Bereiter, C. (1994). Constructivism, socioculturalism, and Popper's world 3. Educational Researcher, 23(7), 21-23.

Bower, G.H., & Morrow, D. (1990). Mental models in narrative comprehension. Science, 247, 44-48.

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18, 32-42.

Bruner, J.S. (1990). Acts of meaning. Cambridge, MA: Harvard University Press.

Cole, H. P. (1997). Stories to live by: A narrative approach to health-behavior research and injury prevention. In D. S. Gochman (Ed.), Handbook of health behavior research IV: Relevance for professionals and issues for the future, (pp. 325-349) New York: Plenum.

Cole, H.P. (1995). Factors that contribute to miners committing unsafe acts. Invited paper presented to the 85th Annual Convention of the Mine Inspector's Institute of America, Canaan Valley Resort, WV, June 11-14.

Cole, H.P., Lindberg, J., Phillips, S.E., Struttmann, T., Brandt, V., Muehlbauer, J., Piercy, L., & Perera, R. (2001). How and why Kentucky farmers retrofit their tractors with ROPS and seat belts. Lexington, KY: Southeast Center for Agricultural Health and Safety, University of Kentucky Technical Report to CDC/NIOSH.

Cole, H.P., Vaught, C., Wiehagen, W.J., Haley, J.V., & Brnich, M.J. Jr. (1998). Decision making during a simulated mine fire escape. IEEE Transactions of Engineering Management, 45, 153-

162.

Das, J.P. (1995). Some thoughts on two aspects of Vygotsky's work. Educational Psychologist, 30, 93-97.

Fishbein, M. & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Adisen-Wesley

Freire, P. (1990). Pedagogy of the oppressed. (32nd printing). New York: Continuum.

Gagne, R.M. (1984). Learning outcomes and their effects: Useful categories of human performance. American Psychologist, 39, 377-385.

Gentner, D., & Stevens, A. L. (Eds.), (1983). Mental models. Hillsdale, NJ: Erlbaum.

Gherardi, S. & Nicolini, D. (2000). The organizational of learning in communities of practice. Journal of Management Inquiry, 9(1), 7-18.

Gherardi, S., Nicolini, D, & Odella, F. (1998). What do you mean by safety? Conflicting perspectives on accident causation and safety management in a construction firm. Journal of Contingencies and Crisis Management, 6, 202-212.

Howard G.S. (1991). Culture tales: A narrative approach to cross-cultural psychology and psychotherapy. American Psychologist, 46: 187-197.

Kirshner, D. & Whitson, J.A. (1997). Situated cognition: Social, semiotic, and psychological perspectives. Mahwah, NJ: Erlbaum Associates.

Lave, J. & Wenger, E. (1994). Situated learning: Legitimate peripheral participation. New York: Cambridge University Press.

Mayer, R. E. (1996). Learners as information processors: Legacies and limitations of educational psychology's second metaphor. Educational Psychologist, 31(3/4), 151-161.

Murphy, D. J. (1992). Safety and health for production agriculture. St. Joseph, MI: ASAE.

Resnick, L.B. (1987). Learning in school and out. Educational Researcher, 16, 13-20.

Sarbin, T.R., (Ed.). (1986). Narrative psychology: The storied nature of human conduct. New York: Praeger.

Skinner, B.F. (1953). Science and human behavior. New York: Macmillan.

Wallerstein, N. (1992). Powerlessness, empowerment, and health: implications for health promotion programs. American Journal of Health Promotion, 6, 197-205.
Wallerstein, N., & Bernstein, E. (1988). Empowerment education: Freire's ideas adapted to

health education. Health Education Quarterly, 15, 379-394.

Wallerstein, N., & Wenger, M. (1992). Health and safety education for worker empowerment. American Journal of Industrial Medicine, 22, 619-635.

Wertheimer, M. (1938). Gestalt theory. In W.D. Ellis (Ed.) Source book of Gestalt Psychology, New York: Harcourt, Brace & Co.