Structuring Peer Interaction to Promote High-Level Cognitive Processing
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THERE ARE MANY DIFFERENT KINDS of peer learning, and, as other articles in this issue attest, it is important to match the peer learning approach a teacher selects to the requirements of the learning task. One distinction among learning tasks that is relevant to this matching process is the nature of the cognitive processing demanded by the task.

High-Level Cognitive Processing

Some peer learning tasks, such as review and comprehension tasks, require primarily recall and repetition of material or simple application of concepts learned. Such tasks promote mastery of skills and content and may entail students working together to review math facts, learn spelling words, or check each other's comprehension of science concepts. In contrast, there are other peer learning tasks that demand a higher, more complex, level of cognitive processing. Examples of these tasks include: working together to solve ill-structured problems and problems with several possible solutions, peers analyzing and integrating ideas to go beyond presented material to build new knowledge, group decision making, peer assessment of learning products, and peer tutoring. These more complex learning tasks require high-level cognitive processing; that is, critical thinking, problem solving, and decision making.

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The focus of this article is on the kind of peer learning that demands high-level cognitive processing. High-level cognitive processing involves making inferences, drawing conclusions, synthesizing ideas, generating hypotheses, comparing and contrasting, finding and articulating problems, analyzing and evaluating alternatives, monitoring thinking, and so on. Peer learning tasks that require critical thinking, problem solving, and decision making can be challenging for both the teacher and students. However, there are ways to structure peer learning to ensure that learners engage in high-level cognitive processing.

Peer Interaction Influences Cognitive Processing

From a Vygotskian perspective (e.g., Vygotsky, 1978), learning is socially constructed during interaction and activity with others. Research on peer learning (Cohen, 1994; O'Donnell & King, 1999; Webb & Palincsar, 1996) has shown that the interaction between and among the learners in a group influences the cognitive activity that is occurring, and it is this cognitive activity that accounts for the learning that takes place.

Different types of interaction facilitate different kinds of learning. Peer-assisted rehearsal (e.g., repetition) of material is usually sufficient for learning factual material. Therefore, group interaction that consists of merely requesting and providing

information promotes review and mastery of skills and other such comprehension tasks. In contrast, for high-level complex learning to take place, the thinking and interaction within the group must also be of a high cognitive level, characterized by the exchange of ideas, information, perspectives, attitudes, and opinions (Cohen, 1994). This kind of discussion generates thought-provoking questions, explanations, speculations, justifications, inferences, hypotheses, and conclusions. Yet, research (Pressley, McDaniel, Turnure, Wood, & Ahmad, 1987; Vedder, 1985; Webb, Ender, & Lewis, 1986) has shown that this kind of thoughtful interaction usually does not occur spontaneously. Without teacher intervention to structure the group interaction in some way, students working in groups do not elaborate on material or ask many thought-provoking questions during discussion. In fact, unless the teacher intercedes with explicit guidance in how to interact, students working in groups appear to be more focused on finding the right answers than on learning. The question, then, becomes how can more thoughtful interaction be promoted?

Structuring interaction

Recent research has shown that peer interaction within a learning group can be structured in ways that guide and support high-quality thinking and discussion (Cohen, 1994). Moreover, different kinds of learning tasks are best guided by structures specifically designed to support those particular kinds of task. The focus in those research studies has been on structuring the interaction so students are forced to follow a particular pattern of talk in the group, thus controlling the nature and quality of their discussion and learning.

A number of peer-learning approaches have been developed that use question-asking and answering to structure interaction at a high cognitive level for a variety of learning tasks. These include "Strategic Questioning," a set of strategic questions for effectively structuring group problem solving (see King, 1991, for a full description of this approach), "Pairs Squared," an approach for developing skills of reasoned argument (King, 1995), and several models of peer tutoring (King, 1993, 1997; King, Staffieri, & Adelgais, 1998). The remainder of this article presents another of these structured approaches, "Guided Reciprocal Peer Questioning."

This approach is illustrated within a specific peer-learning scenario accompanied by an example of the resulting group interaction indicating progression toward task completion.

Guided reciprocal peer questioning

Mr. Garcia is teaching his ninth-grade world cultures class the concept of "culture." Following a 20-minute presentation using charts and overhead slides, he signals to the class to get into their peer-learning groups. The students form groups of three. Mr. Garcia projects a chart on the overhead screen that displays a list of 15 generic questions, which he calls "think type" questions. All of these questions are in the form of question starters, such as, What does . . . mean? How are . . . and . . . different? What would happen if . . .? and What conclusions can you draw about . . .? (see Figure 1). Within a few minutes, each student in

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What is a new example of . . . ?
How would you use . . . to . . . ?
What would happen if . . . ?
What are the strengths and weaknesses of . . . ?
How does . . . tie in with what we learned before?
Explain why . . . Explain how . . .
How does . . . affect . . . ?
What is the meaning of . . . ?
Why is . . . important?
How are . . . and . . . similar? How are . . . and . . . different?
What is the best . . . and why?
Compare . . . and . . . with regard to . . .
What do you think causes . . . ?
What conclusions can you draw about . . . ?
Do you agree or disagree with this statement: . . . ? Support your answer.

Figure 1. Questions for Guided Reciprocal Peer Questioning

the class (working individually), using the generic questions as a guide, has selected appropriate question starters and has written down at least two specific questions on the lesson topic by filling in the blanks with material from the lesson. At another signal from Mr. Garcia, the small groups begin to discuss the lesson material, with each student taking turns posing his or her specific questions to the group to stimulate discussion:

Sally: In your own words, what does *culture* mean?

Jim: Well, Mr. Garcia said in the lesson that a culture is the knowledge and understandings shared by the members of a society. I guess it's all the things and beliefs and activities that people in a society have in common. It includes things like religion, laws, music, medical practices . . . stuff like that.

Sally: And dance, art, family roles.

Barry: Knowledge includes language. So, I guess culture includes language, too.

Jim: I guess so. Actually, I have a question about that: How does a culture influence the language of a society?

Barry: Well, for one thing, the language is made up of words that are important to the people of that culture. Like, the words name things that the people care about, or need, or use. And so, different cultures would have different vocabularies. Some cultures may not even have a word for *telephone*, because they don't have any. But, phones are important in our culture, so we have lots of different words for phones, like *cell phone, digital phone, desk phone, cordless phone, phone machine,* and. . . .

Jim (laughing): I'll bet desert cultures don't have any words for *snow* or *skiing*.

Sally (turning to Barry): What's your question?

Barry: I've got a great question! You'll never be able to answer it. What would happen if there was a group somewhere without any spoken language? Maybe they were all born not being able to speak, or something like that. How would that affect their culture, or could there even *be* a culture?

Sally: Well, it would mean they couldn't communicate with each other.

Jim: And they wouldn't have any music! Because they wouldn't be able to sing.

Barry: But wait! Why couldn't they communicate? Maybe they would develop a nonverbal language system, you know, the way people use hand signals, or the way deaf people use sign language.

Sally: I didn't think of that! But it would be difficult for them to communicate with anyone who was out of their line of sight, like if they had their backs turned.

Barry: Well, not if they could hear. Just because they couldn't *speak* doesn't mean they couldn't *hear*. If they were able to hear, they could communicate with drums or clackers of some sort. But they'd have to carry their drums around with them all the time so they could "talk" to each other. . . .

Sally: Then maybe drums would become very important to them, and some people would have bigger, louder, or more decorated drums than others. The drums might even become a status symbol, a way to tell who were the important people in the society and who were not so important.

Jim: What made you think of that?

Sally: We learned about status and status symbols last year in social studies.

Barry: Or maybe they'd clap their hands in a lot of different ways to communicate with each other. Then they wouldn't have to carry the drums around.

Jim: Well, if they could hear, then they *could* have music after all, but they still wouldn't be able to *sing* to their music.

The students continue asking and answering each other's questions. During this question-asking and answering process, Mr. Garcia circulates among the groups listening to their discussions. After a while he signals that the discussion time is over. He then brings the class together to share ideas, inferences, examples, and explanations generated, to clarify any misunderstandings that the students might have uncovered regarding culture, and to discuss questions they still have.

Promoting Cognitive Processing

This scenario illustrates how the Guided Reciprocal Peer Questioning approach structures the group interaction so high-level cognitive processing results. Mr. Garcia's students were engaged in several different cognitive activities during this sequence of guided reciprocal peer questioning and responding—and even before.

The most important structuring device of this approach is the question starters that are provided to students to guide their peer discussion. Mr. Garcia was well aware of the importance of carefully selecting the question starters students used. He realized that the format of the *generic* questions would control the quality of the *specific* questions students asked, and that those questions, in turn, would influence the level of student thinking during discussion. In essence, student thinking and interaction were dictated by the particular type of question posed. Different kinds of question starters promote different types of cognitive processing. The question starters are designed to prompt students to engage in several forms of cognitive activity: review and consolidation of their understandings, checking their comprehension, constructing new knowledge, and monitoring how well they are thinking and learning.

Some of the question starters promote comprehension-checking (e.g., What does . . . mean?

and Describe . . . in your own words.). Asking and answering these questions is a form of self- and peer testing, allowing students opportunities to check how well they (and their peers) understand the material, as well as to clarify misunderstandings, correct errors, and fill in gaps in knowledge. These questions are not very thought provoking in the sense that they are memory-based—they simply ask for recall of previously presented material. But they do require students to restate definitions, descriptions, and procedures by paraphrasing material in their own words. By requiring paraphrasing (as opposed to stating definitions verbatim as presented in class), these comprehension questions induce some reconceptualization on the part of the responder, and, at the same time, elicit evidence of real understanding (i.e., indications that knowledge has been assimilated into the responder's cognitive structures). For example, in the dialogue above, Sally asked for the *definition* of a term and Jim, in the first part of his response, parroted Mr. Garcia's definition. However, Jim went on to elaborate somewhat on the term by restating the definition in his own words, thus suggesting that he had reorganized his thinking by incorporating the concept into his own knowledge structures. Jim's response appears to be accurate and stated in his own words; however, Sally apparently felt it was incomplete or needed some elaboration, so she added several items. Thus, the two students were collaboratively reconstructing the definition of culture as presented in class. Mediating each other's understanding of *culture* in this way results in a more complete definition than either of the students would likely have arrived at on their own.

Knowledge construction and integration

At a more complex level of learning, asking and answering thought-provoking questions forces students to actually think deeply about the material, integrating it with prior knowledge and constructing new knowledge. First, Mr. Garcia's students had to engage in high-level thinking about the lesson content just to be able to formulate relevant, thought-provoking questions. To generate their specific questions, students not only had to identify the main ideas of the lesson, but they also had to consider how those ideas relate to one another and to their own existing knowledge. Further-

more, answering such questions requires students to make connections among ideas and generate explanations, elaboration, speculations, inferences, and other forms of new knowledge. For example, some of the questions (e.g., Explain why . . . and How do you account for . . . ?) are designed to elicit explanations from the group members. In order to respond to these questions, the other students in a group have to construct explanations and communicate those to the questioner. Explaining something to someone else often requires the explainer to think about the material in new ways, such as relating it to the questioner's prior knowledge or experience, translating it into terms familiar to the questioner, or generating new examples. According to theories of the social construction of knowledge (e.g., Bearison, 1982), such cognitive activities force the explainer to clarify concepts, elaborate on them, reorganize thinking, or reconceptualize the material in some manner. Webb's (1989) extensive research on interaction and learning in peer groups indicates that giving such explanations improves comprehension *for the individual doing the explaining*. To illustrate, in the dialogue above, Barry's explanations of how culture influences language showed concept clarification, and his own example of the relationship between culture and language (e.g., the various words for *telephone* in U.S. culture) was an elaboration of that concept. Similarly, Barry's inclusion of language as a new example of culture was an indication of reconceptualization on his part.

Some of the high-level question starters are designed to go beyond explaining the material presented to requiring that new knowledge be constructed. The purpose is to promote not only multiple connections between new ideas and prior knowledge but also to stimulate the construction of many different *kinds* of high-level connections (e.g., evaluative relationships, comparison relationships, and evidential relationships). Thus, the purpose of such questions is to cultivate not only *many* connections but *different kinds* of connections. When students think about class material by entertaining many and varied high-level questions, they process the ideas more thoroughly and construct for themselves extensive, richly integrated, and varied cognitive networks in which new ideas are connected together and linked in different ways to what they

already know. Developing such cognitive networks provides more cues for recall and makes the connections more stable and durable over time, making them easier to remember.

When Barry asked "What would happen if there was a tribe somewhere without any spoken language? . . . How would that affect their culture, or could there even *be* a culture?", he was asking the other students to go beyond what they had already learned about culture in class, to develop new knowledge on their own by extension from their existing knowledge. In asking them to speculate about a culture without spoken language, Barry was asking the group to analyze what *culture* and *language* mean, how they relate to each other, and to construct new knowledge about these relationships. Clearly, Barry himself had already begun to think about those relationships. In fact, he could not have generated the question without having begun to consider how lack of spoken language affects culture. However, in verbalizing his question, he drew Sally and Jim into thinking about these possibilities.

In the discussion precipitated by Barry's question, the three students together explored the relationship between culture and language by speculating about how culture would be without language. As their responses played off each other's, they undoubtedly forged new links among the ideas presented in the lesson and between those ideas and their own prior knowledge. For example, Sally integrated the new information with cultural concepts (e.g., status) that she had learned in a previous class. Thus, asking and answering questions based on the lesson content fostered these students' comprehension and knowledge building by stimulating them to think about how the ideas relate to each other and to their own existing knowledge. We might also say that in asking his question, Barry was mediating Sally's and Jim's learning (as well as his own). It is unlikely that either student alone would have speculated about such a situation; if they had, it is doubtful that they would have actually analyzed the hypothetical situation to arrive at such a plausible scenario.

Socio-cognitive conflict

Still other question starters are designed to get students to express differing points of view and discrepant information in order to create what Piaget calls cognitive dissonance and neo-Piagetians call socio-cognitive conflict (Mugny & Doise, 1978). When students are exposed to alternative perceptions and conflicting views, and are put in such a state of cognitive imbalance, they are motivated to continue the discussion in order to resolve the cognitive conflict. Interaction with their peers requires students to confront any differences in each other's current understanding of a topic as well as their differing attitudes or perspectives. Then, through explaining and defending their views to their group, those conflicts can be reconciled. Thus, through discussion, they arrive at negotiated meaning (social construction of knowledge). In doing so, individuals reformulate their own thinking and alter their knowledge structures—that is, they learn.

During Guided Reciprocal Peer Questioning, when students ask and answer thought-provoking questions, (e.g., What do you think would happen if . . . ? or Do you agree or disagree with this statement? Why or why not?), the format of those questions taps into students' different views on the matter. Once these differing views (or conflicting information) are exposed, individuals engage in elaborating, explaining, justifying, and other socio-cognitive behaviors, which may lead to reconciling those differences to reach negotiated meaning. Therefore, Guided Reciprocal Peer Questioning promotes the process of exposing and reconciling such discrepancies by controlling the direction of a discussion.

In the scenario above, for example, Sally responds to Barry's question by saying that if there were no spoken language, people couldn't communicate. Her response shows that it has not occurred to her that there are other ways to communicate. When Barry suggests another possibility—that there could be a nonverbal language—his comment appears to raise a slight conceptual discrepancy between Sally and himself as to what constitutes language. During social construction of knowledge, challenging each other's perspectives on an issue or offering another point of view in this way induces socio-cognitive conflict (Mugny & Doise, 1978), which often leads to subsequent resolution through discussion. And, in fact, Sally's following contribution to the discussion about the use of drums to communicate shows that she has reconciled Barry's perspective on language with her own.

Metacognition

In general, the question-asking and answering structure serves a metacognitive purpose also. That is, the process per se of asking and answering particular questions functions to help students monitor and regulate their understanding of the material and their ability to extend their learning by going beyond that material to construct new knowledge. In addition, students using Guided Reciprocal Peer Questioning are trained to ask specific "thinking-about-thinking" (metacognitive) questions throughout the discussion as they see fit. Questions such as, What made you think of that? and What is your reasoning?, prompt students to reflect on the thinking that led to their response. Repeatedly "thinking about their thinking" in this way presumably promotes students' awareness of their thinking processes, which may further improve their thinking and learning. For example, when Jim asked "What made you think of that?", he was prompting Sally to think about, and make explicit, the connection she had made. At the same time, he was also reminding all three of them that ideas do not come from nowhere and we can usually become more fully aware of the genesis of our ideas if we reflect on our thinking processes. When Sally replied "We learned about status and status symbols last year in social studies," she demonstrated her ability to monitor her thinking to the extent of being aware of the connection she had made.

The structure of Guided Reciprocal Peer Questioning has a retroactive impact also. Even before Mr. Garcia's students began their discussion, they were actively involved in processing the information *during* Mr. Garcia's lesson. Because this was not the first time these students had used this approach to learning, they knew they would be required to make up questions for the post-lesson discussion; therefore, they paid close attention to the lesson. Most of them even began to formulate their questions while listening to the lesson, and some actually jotted down a question or two in their notes. This kind of attention enhances students' initial understanding or encoding of the material during the lesson.

Importance of the Group Context

Although the level and variety of the questions used to guide discussion is the major structuring device that accounts for the success of Guided Reciprocal Peer Questioning (e.g., King, 1994), the small group context also structures the interaction in effective ways. Mr. Garcia's choice of 3-member groups was intentional. This group size requires participation by everyone (it is hard to "lurk" in a group of three). Groups of three also allow for, and even enable, the emergence of alternative views, which may lead to cognitive conflict, as we saw with Sally's and Barry's differing perspectives on what qualifies as language. In a larger or smaller peer group context, it might be easier for group members to go along with others' views even though they do not agree. The reciprocal roles of question-asker and responder also structure the interaction so that everyone participates in high-level thinking and learning.

Conclusion

In general, the interaction in groups using Guided Reciprocal Peer Questioning is structured by the format of the questions used and by the group members' reciprocal process of asking and answering each other's questions. Because the questions posed are high-level ones, they promote high-level thinking and learning—going beyond the material presented to the construction of new knowledge.

References

Bearison, D.J. (1982). New directions in studies of social interactions and cognitive growth. In F.C. Serafica (Ed.), *Social-cognitive development in context* (pp.199-221). New York: Guilford.

Cohen, E.G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research, 64,* 1-35.

King, A. (1991). Effects of training in strategic questioning on children's problem-solving performance. *Journal of Educational Psychology, 83,* 307-317.

King, A. (1993). *Ask your partner to think.* Unpublished manuscript and materials, California State University San Marcos.

King, A. (1994). Guiding knowledge construction in the classroom: Effects of teaching children how to question and how to explain. *American Educational Research Journal, 30,* 338-368.

King, A. (1995). *Pairs Squared (Pairs²): Peer learning for increasingly complex tasks.* Unpublished manuscript and materials, California State University San Marcos.

King, A. (1997). ASK to THINK - TEL WHY: A model of transactive peer tutoring for scaffolding higher-level complex learning. *Educational Psychologist, 32,* 221-235.

King, A., Staffieri, A., & Adelgais, A. (1998). Mutual peer tutoring: Effects of structuring tutorial interaction to scaffold peer learning. *Journal of Educational Psychology, 90,* 134-152.

Mugny, G., & Doise, W. (1978). Socio-cognitive conflict and the structure of individual and collective performances. *European Journal of Social Psychology, 8,* 181-192.

O'Donnell, A.M., & King, A. (1999). *Cognitive perspectives on peer learning.* Mahwah, NJ: Erlbaum.

Pressley, M., McDaniel, M.A., Turnure, J.E., Wood, E., & Ahmad, M. (1987). Generation and precision of elaboration: Effects on intentional and incidental learning. *Journal of Experimental Psychology, 13*(2), 291-300.

Vedder, P. (1985). *Cooperative learning: A study on processes and effects of cooperation between pri-mary school children.* Groningen, The Netherlands: University of Groningen.

Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Webb, N.M. (1989). Peer interaction and learning in small groups. *International Journal of Educational Research, 13,* 21-39.

Webb, N.M., Ender, P., & Lewis, S. (1986). Problem-solving strategies and group processes in small groups learning computer programming. *American Educational Research Journal, 23,* 243-251.

Webb, N.M., & Palincsar, A.S. (1996). Group processes in the classroom. In D.C. Berliner & R.C. Cafree (Eds.), *Handbook of Educational Psychology* (pp. 841-873). New York: Simon & Shuster MacMillan.

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