Teaching At Higher Levels Of Cognition

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Introduction

Students in colleges of agriculture are often shortchanged by their professors. In fact, the situation could be severe enough in some cases for the students to win malpractice suits using "failure to encourage thinking" as their claim. This is a serious allegation, but professors of agriculture often fall short of encouraging students to think beyond rote memorization of facts.

More Than Rote Memorization

The allegation that professors fail to move students beyond rote memorization of facts would not be so severe if rote memorization was enough to prepare students for everyday living, but it is not. Certainly it is agreed that students need to be taught facts on which they can build a knowledge base for future thinking; however, professors often stop after delivering the facts and assessing whether students have memorized.

Professors who care about their teaching and who care about equipping students for everyday living will want to teach more than rote memorization of facts. Professors need to encourage students to translate information into their own words, make estimations or predictions based on understand-

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ing of trends and conditions, brainstorm, formulate and express answers, lead discussions, and evaluate products and processes.

Moving From Memorizing To Evaluating

For students to develop the ability to evaluate products and processes, they must start with simple thinking ability--memorization of facts. Some authors refer to this level of thinking as "remembering" (Newcomb and Trefz, 1987). Most college students are already very proficient at this level of thinking.

From the remembering level students move in a hierarchical fashion to the "processing" level. Processing involves using known facts in meaningful ways, applying classroom information to a real-life setting, or analyzing a situation.

Once students have mastered remembering and processing, they can move to the "creating" level. At the creating level, students combine pieces of previously taught material and earlier experiences to form something new to the student. Finally, with practice at each of the preceding levels, the complex thinking ability--evaluation of products and processes is possible.

Going Beyond Remembering

Instructors can use a number of teaching techniques to move students through the hierarchy from remembering to evaluating. One or more of the following suggestions may help:

establishment of the appropriate departmental climate--supportive open environment--marked by honesty and openness. When heads use the behavioral framework associated with recruitment, communication, goal identification, support, evaluation/intervention, and recognition, faculty members inevitably have higher morale, are more productive and tend not only to enhance the performance of the chairperson, but to achieve the goals of the department. At the same time, the techniques associated with faculty management help the chairperson guide the department in exciting and future directions by also enhancing growth and development of all faculty members.

The results of this study suggest that chairpersons' effectiveness as faculty developers could be enhanced by stronger institutional support. In this regard, deans and other administrators in Colleges of Agriculture can assist chairpersons in their efforts to enhance the professional development of faculty. This assistance can be accomplished in several ways. First, institutions should select academic department heads based as much on their management qualifications as on their reputations as scholars. To help determine the prospective department head's management orientation, search committees should develop a series of questions to be used in the interview process to determine the candidate's approach to human resource management. In addition, the job announcement should reflect the value placed upon human

resource management skills by the institution.

Next, the development of pre-service and in-service training directed toward faculty development and other issues confronting academic department chairs is warranted. New chairperson orientation focusing on human resource management and involving deans, vice chancellors, experienced department heads, and administrative staff development experts is also suggested. Deans would be advised to cover university and college policies and procedures as part of this orientation process.

Finally, chairpersons should be evaluated for their efforts to successfully foster the professional development of faculty. Recognition of these efforts would demonstrate to both faculty and chairpersons the value that the institution places on faculty members and on their professional growth and development.

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1. Encourage students to question one another. How did you reach that conclusion? Why is that important? Is that a reliable source? Where can we get more information? What should be the next step?

2. Assign more small group work such as buzz groups, and brainstorming sessions, where students are encouraged to verbalize the comparisons of conflicting interpretations. Give the students two pieces of research with conflicting findings. The students could then draw conclusions as to why the results differ, report the conclusions to the class, and compile a listing of the possible reasons for the conflicting results.

3. Assign students more speech writing, proposal writing, report writing, interviewing (both preparing to interview someone else, and preparing oneself for an interview).

4. Use "decision-making charts" (e.g. possibilities factors chart, see example below) to assist students in visualizing the process of decision making. The question could be, "Which computer printer should I buy"? The chart could look something like the following:

Decision: I would buy the Epson LQ-800. Even though it

		FACTORS		
POSSIBILITIES	Price	Print Quality	Speed (Draft)	Dot Matrix Vs Ink Jet
Epson LQ-800	799	E	VG	DM
Okidata 292	749	VG	E	DM
IBM Proprinter	549	G	VG	DM
HP Thinkjet	495	F	G	IJ

Note: E=excellent, VG=very good, G=good, F=fair (Adapted from Consumer Reports, May 1987, Vol 52 #5

is the highest priced printer, with all factors considered, it received the highest ratings for the price.

The richness of the exercise lies in walking the students through developing the chart. The dialogue involved in arriving at the decision is the key to achieving higher level thinking.

5. Use more modeling. Professors are the subjects of a one-shot case study each time they encounter students. Everything professors do and say is observed by students; therefore, professors should plan all that is seen and heard such that students will want to imitate it. The often forgotten entity in modeling is modeling thoughts. Students cannot appreciate a professor's thinking process until the process is either verbalized, written or diagrammed. Modeling involves a conscious effort on the part of professors to be exemplary in their planning, teaching, advising, thinking, and writing.

Advanced preparation for class allows time for professors to plan for incorporating modeling by imagining the students and themselves in the classroom. This is the time for outlining appropriate teaching methods, thinking through possible dialogue, writing down the thoughts that are taking place as the lesson is being written, and purposefully weaving those thoughts into the classroom situation so students can benefit from the professors' thoughts.

6. Role playing is highly underused in classrooms. Placing students in the role of a certain character may increase their desire to know more about that character thereby causing them to delve into the literature. Choose a current issue being debated in the state legislature and assign the students the role of a particular congressman or congresswoman, a local business person, and other key individuals in the debate. Allow the students to play out the role.

7. On the chalkboard, lead the class through the building of models that describe processes. For example, once the students have been taught that latent variables are diagramed as circles, measured variables are expressed as squares, and relationships are written as directional arrows, ask the students to write, in their own words, the meaning of the following diagram.
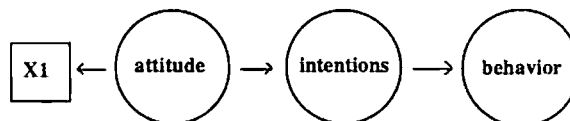
8. Provide outside assignments which allow students to be creative. There does not have to be only one answer nor only one approach to completing a given assignment. Encourage students to show the utility of their creative solutions by explaining "how" the answer would be put into practice.

9. Write test items at higher levels of cognition. Since students seem to "learn to test" and study according to what is on the test, it seems that writing test items at higher levels would encourage students to think at higher levels. The following examples were adopted from tests written by professors in the College of Agriculture at The Ohio State University.

"You are an apple tree grower who has experimented with four training systems: the umbrella kniffen system, the Lincoln canopy system, the open center system and the central leader system. You have decided to publish your results and to recommend to Ohio apple tree growers the best system for them. Choose one of these systems, describe it thoroughly, state your recommendations, and give reasons to support your choice."

Higher level questions are not limited to essay-type questions. It is possible to encourage students to bring together several pieces of earlier information and arrive at a solution (higher level thinking) via multiple choice questions. It becomes more difficult as the level increases on the hierarchy, but it is possible, with practice. The following example illustrates a multiple choice question at a level of cognition beyond comprehension.

"Which method of cooking would most be desirable for a muscle region in which fibrous connective tissue content was high? (a) roasting (b) broiling (c) braising (d) frying?"

10. Use more discussion. To encourage student interaction, professors could assign readings from which each student would be required to write questions for the next class. The professor's lecture-discussion would be based on the questions asked by the students.

11. Expect students to use course content in projects that require higher level thinking. After teaching the subject matter specific facts, and using higher level discourse in the classroom instruction, design assignments and tests

that urge students to practice the course content at a level beyond rote memorization. Enhance the potential of the assignment by using the students' responses to generate higher level discourse and deeper questioning among students. An appropriate method for accomplishing greater student interaction might be the case study method. Professors using case studies from their discipline could have students applying and analyzing as well as creating new procedures and products and processes. For example, develop a case study regarding a potential new market for an agricultural product. Ask students to a) analyze the background information to determine feasible possibilities and b) draw upon learning in previous courses in several disciplines to create scenarios that might be tried. Time permitting there could be application of the possibilities followed by evaluation of the results.

12. Depart from traditional lecture periodically. Class time can be organized in unique and creative ways. For example, use only the last one-third of the class time for traditional lecture. From that portion of class, the students would prepare for the next class by reading information related to the lecture topic. The students come to the next class prepared to spend the first one-third of the class time answering an essay question prepared by the professor. After collecting the responses, the middle one-third of the class is spent discussing that which was written by the students.

Another example might be for professors to use Punctuated Lecture (Cross and Angelo, 1988). During the last ten minutes of a traditional lecture the professor could ask the class to reflect over the previous ten minutes of the lecture to recall and reconstruct their mental activities. Guiding questions might be, "Were you concentrating on the lecture?", "What were you doing to make connections between previously learned material and lecture material?", or "What did you expect to come next in the lecture and why?". If this technique is used periodically at the beginning of a new quarter or semester, students may begin to automatically use these questions to check themselves throughout all lectures.

This type of self-monitoring is important to achieving higher levels of cognition.

Instructors Should Be Cautious

There are always points of concern associated with trying out new and challenging techniques of teaching. The following list attempts to detail some of the points of caution which should be considered by Instructors.

1. Instructors should test at higher levels of cognition only if objectives have been set that reflect higher levels of thought and if teaching takes place that addresses these higher level objectives. It is unfair to students to test at the creating and evaluating levels if there are no indications in the course objectives that such higher level behaviors are expected. Likewise if none of the course experiences prior to the test provide students with practice (and instruction) in higher level thinking and then the test demands it, students will feel a sense of injustice.

2. Instructors need to be aware that it is difficult to grade much of the work that reflects student performance at higher levels of cognition. One reason is because the answer or approach may be completely different than any previously written answer or approach. Another reason is that the grading is often partially or totally subjective.

3. Instructors should be ready to discover that initial attempts by students to think and write at higher levels of cognition may reflect their inexperience. Patience and guidance are valuable in teaching students to operate across the full range of their cognitive abilities.

4. Instructors cannot neglect content in favor of process. In the excitement of attempting to incorporate higher level thinking into the curriculum, Instructors should not abandon basic, sound subject matter. Teaching at higher levels takes time, but the time that it takes should not be in lieu of vital knowledge and skills. There may be a way to teach old, proven principles in a new way that reflects higher level thinking.

5. Instructors should realize that considerable effort on their part may not result in an apparent change in the thinking behavior of the student. It is possible that one quarter or one semester will not be sufficient to dramatically change the behavior of the students--or the professor.

6. Instructors will discover that it is difficult to teach at higher cognitive levels because students resist thinking at higher cognitive levels. It is much easier to memorize and repeat than it is to ponder, inquire into, associate, and evaluate. It is easier for the student; it is likewise easier for the professor to teach at the lower levels.

7. Since discussion takes time, Instructors may have to narrow the number of topics and cover less, but cover it more thoroughly. Instructors may choose to save valuable class time by encouraging and rewarding discussion among students outside of class. This might be accomplished by assigning each student to a small group whose task it is to read, record a one hour discussion of the readings, turn in the tape along with a one page summary, and be prepared for a ten minute dialogue with the professor at the beginning of the next class. Discussion either in class or outside of class will make it possible for students to accomplish greater understanding of the subject matter.

8. Entire departments need to work together to foster a common commitment toward teaching higher level thinking skills.

Conclusion

The challenge of teaching at higher levels of cognition could result in Instructors becoming frustrated and discouraged; frustrated over changing their own teaching behaviors and discouraged over changing their students' thinking behaviors. Even so, it is imperative that the challenge be pursued.

As agriculture continues to change at a rapid pace, facts taught quickly become obsolete. Teaching students to think at higher levels rather than to memorize basic facts will insure professors that what they are teaching will endure a changing agriculture.

Not only will agriculture benefit, but professors will

A TRANSFER MODEL OF SHUTTLE TRAINING

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Abstract

The shuttle training model is advanced as a method to transfer technology through human resource development. The eight-step model integrates seven critical concepts to transfer training courses from donor to recipient institutions. The three key factors are (1) a training team with strategic residence at one institution, (2) the ownership principle resting with the recipient institution, and (3) adaptable courseware materials supplied by the donor institution.

Introduction

In any development program, there is an express need to expedite the transfer of technology. Almost without exception, the transfer process involves the development of human resources. Subsequently, there is a need to have, in residence within the target country, a team of experts with competencies in both the technology to be transferred and the science of training.

This paper advances a model of shuttle training as a strategy to transfer technology through the development of human resources. The objective is to set in place a mechanism to adapt and transfer technology with some semblance of perpetuity in a particular cultural setting -- a generator to receive and disseminate technology through training. The model is intended for small group (30 participants) training programs of short duration (1 week to 4 months). It is composed of eight steps between a source or donor institution that possesses technology and a receiver or client institution that desires the technology.

The shuttle training model is based on seven requisites integrated into eight steps.

Requisites For Shuttle Training

1. The Experiential Concept

Educational research has long substantiated that people learn and remember what they do. Doing facilitates both information recall and problem solving. Active participation

in a practical, applied problem solving situation is essential to transferring technology through training programs.

2. The Critical Mass Concept (Team of Five)

A critical mass of energy is essential to effect quality experiential training. Subsequently, there must be an adequate human resource pool that can conduct and manage training programs. This includes not only the training experts but support staff as well. To affect quality training, the trainers must be master trainers -- steeped in the principles of cognitive psychology, courseware development, self-learning principles, the science of distance learning, and the application of experiential methods. In this respect, a critical mass or team of five such transfer agents is essential to obtain adequate teaching ratios and management support. One team member should act as coordinator and another should be skilled in the area of training media and instructional resources.

3. Administrative Facilitation Concept

Experiential training requires resources and capital outlay, especially in the initial stages. Administrative commitment to the experiential training concept and provision of the resources required for its implementation are essential for implementing the shuttle training model.

4. Strategic Entry Concept

Any experiential training program has a greater probability for success if there is a selected strategic location for its entry into a region. This location should have the amenities that will perpetuate the training program and subsequent technology transfer. Examples of such amenities would be a critical mass of resident content experts, conducive training environments i.e., classrooms, laboratories, electronic media, housing and dining facilities, etc.

5. Needs Assessment Concept

The requirements necessary to conduct quality training programs that effectively change behavior are enormous. Thus, a comprehensive needs assessment is essential to identify constraints and draw up a curriculum responsive to client needs.

6. Courseware Concept

The process of printing was developed many centuries ago. Since then, reading printed materials has became a major means of inputting information and knowledge.

Research in cognitive learning has revealed techniques to produce learner-driven instruction that saves thirty to fifty percent of the time spent in inputting information. This time

benefit as well by becoming better educators. The real benefactors, though, will be the students who will become better thinkers, and thus will be better prepared for life.

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