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ABSTRACT

Community college students (unless cognitively or emotionally impaired) have an innate learning system or process which makes it possible to do abstract and critical thinking in all their classes. Over an 8-year period, informal research has been conducted with approximately 1,000 low- and high-achieving students, and faculty in classrooms, faculty development workshops, and conferences. Student groups were asked to think of something they knew how to do very well, and describe in writing what they went through acquiring their skill level. Then, in groups of three or four, students read their processes to each other to see whether there are any similarities in how they learned. Finally, the group as a whole developed a list of the stages of the learning process that was applicable to all of the different skills. For every group of faculty and for every group of students, whether developmental or advanced, all arrived at an approximation of the following list of stages: (1) motivation; (2) beginning practice; (3) advanced practice to build a foundation upon which control, creativity, and critical and abstract thinking can be applied; (4) skillfulness; (5) refinement; and (6) mastery. One of the most important insights gained from this research is that people learn by making and correcting their own mistakes. Learners cannot start to apply creatively or think critically about a new skill until there has been a sufficient quantity of personal practice and trial and error learning. Only after students have acquired that proper foundation, can they begin to benefit from teachers' lectures. If this natural learning process is followed, people can learn to high levels of critical and creative thinking. (KP)

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The Natural Process of Learning and Critical Thinking

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BY RITA SMILKSTEIN

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THE NATURAL PROCESS OF LEARNING AND CRITICAL THINKING

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In this paper I want to support my view that all our students (unless intellectually or emotionally impaired) are perfectly able to do abstract and critical thinking in all their classes. This view may seem to contradict the fact that some of our students do not catch on and do not think critically in our courses. And because some students do succeed, we reasonably assume the cause of lower achievement lies with the students who are doing the low achieving: Clearly, there must be something wrong with them or what they are doing.

Some educational theorists believe the lower-achieving students are people who have been slower to develop intellectually/cognitively than the higher-achieving students, and are simply less mature. Some theorists believe the lower-achieving students have low motivation, a poor attitude, less intelligence, and/or less aptitude for particular subjects or for college work in general than the higher-achieving students.

Any or all of these causes may explain why certain students can't make it to a high level of thinking in our courses. But what if all these students really are able to do critical thinking in our courses, and would be glad to do so, except that some obstacle outside themselves prevents them from doing so? This possibility cannot be overlooked.

After all, if they can speak — and probably learned to speak when they were around 2 years old — they have been operating at a high level of abstraction, skillfully using their critical and creative faculties, since the time they were 6 years old. To learn language, one of the most — if not the most — complex skills, children have to learn abstract language rules and structures. And this requires the innate ability to make and test hypotheses, synthesize, and solve problems, all of which are critical thinking activities and all of which children do

FIGURE 1 Steps of Learning, Recorded Verbatim

Coordinated Studies Students	Instructors in In-service Workshop	Basic Skills Students
STEP 1		
Training, watching, ask questions, necessity, fear of it, experienced it, having fun with it, found it hard, modified expected results, forced into it, challenged, love of it, intrigued, humiliating, interest, fascinated.	Trial & error, finding the problem, decide to do it, desire or need, motivation, observation, overcoming fear, lack of confidence, taught ? (The question mark signifies that one person contributed the item and others disagreed, but the originator wanted to keep it.)	Have an interest, know you like it, God-given talent, creative ?, practice, start basic.
STEP 2		
Trial & error, development, followed instructions, practice, doing it, experiment, listening, read ?, apprentice, loving it, failure, talking to others who have done it or doing it, discipline, exercises.	Trust someone to help out, instruction, practice, experiment, trial & error, feedback from others, need or desire to improve, give self feedback.	Practice, practice, practice; get comfortable; t . pushed by others, challenge.
STEP 3		
Becoming more comfortable, exercises, practice, sharpening skills, discovering own method, getting feedback, rewards.	Experience, demonstration, evaluating, more trial & error, taking risks, beginning to go solo, imitate, creativity ?	More practice, discipline, positive attitude, devotion, confidence, improving by adding new skills to it.
STEP 4		
Recognition from others, can anticipate results, perfecting it, practice, doing it on own without support, expressing yourself through it, took lessons, becomes natural, feel a part of it, concentration.	Refinement, confident, application, constant, go for it, deviate from what I've learned, creativity, spontaneity, improvisation, take risks, give self feedback.	Keep it going, being inspired, being different from anyone else, branching out, creative.
STEP 5		
Perfecting performance, total enjoyment, learning new methods, understanding why you're doing it, becomes second nature.	Bridging, unique applications, using skill as building block, automaticity, internalization, further refinement, teach others, creativity, seeing cosmic connections, stop doing it and lose some skill.	Good challenge, not giving it up, pushing yourself to keep going so no burn out, high pay/promotion, improvement, self-satisfaction, evaluate progress so far.
STEP 6		
Maintenance/practice, learn to deal with problems, branch into secondary skills, knowing own limits, applying to other fields/broader application, enjoying it, increased creativity, feeling good, letting go of it, teaching others.	— — —	Mastering it, teaching it.

"My hypothesis is that cognitively unimpaired human beings have an innate learning system..."

naturally, without deliberate or conscious effort. This innate intellectual/cognitive capacity doesn't disappear as people get older; they simply may not be able to use it in the classroom. How to help students use their innate critical thinking capacity in our classrooms is one focus of this paper.

My hypothesis is that cognitively unimpaired human beings have an innate learning system or process which makes it possible for us naturally to learn complex, abstract ideas and skills from an early age. When students don't achieve the same high level of learning in school as they did naturally when they were children or when they learn outside of school, it is because they are not learning naturally in school. In other words, 1) some school teaching doesn't give students the opportunity to do natural learning, and 2) some people can't learn unless they can learn naturally. To be clear, I am writing here about only the learning of new ideas and skills; and by "learning" I mean the ability to think about and use the new ideas and skills creatively and critically, as opposed to memorizing information by rote.

This hypothesis is the result of informal research I have been doing for the past eight years with about 1,000 people: low-achieving students, high-achieving students, and faculty in classrooms, faculty development workshops, and at local, state, and national conferences. I am going to describe the results of my research, but, to begin, here is a description of the research method I've used, and I welcome — and challenge — you to use this method with your own students so that you can see for yourselves that your students know very well how to learn to a high level of expertise by the natural learning process. This procedure takes less than 50 minutes, so it can be done during one class session.

First, I ask participants (students in this case) to think of something they know how to do very well (e.g., swim, play guitar, carpentry, use a computer, write), making sure that everyone has a skill (if only driving a car) in mind before we continue. Then I ask them to write down what they went through from their first encounter with this skill until they got to be really good at it. They write for about three to five minutes — until the majority are finished. (I assure them this writing will be only notes for themselves and will not be read to the class nor collected by me.) I then have them, in small groups of three to four, read their processes to each other and compare to see whether there are any similarities in how they learned. This part of the procedure lasts for 10 to 15 minutes again, until a majority of the groups are finished.

FIGURE 2 Summary of Stages

- STAGE 1 — MOTIVATION: Responding to stimulus.
- STAGE 2 — BEGINNING PRACTICE: Doing it ("practice, practice, practice"), learning from one's own mistakes.
- STAGE 3 — ADVANCED PRACTICE: Increase of skill and confidence through more practice, more trial & error, getting comfortable.
FOUNDATION IS BUILT; ONLY NOW CAN CONTROL, CREATIVITY, CRITICAL, AND ABSTRACT THINKING START FOR THIS NEW SKILL.
- STAGE 4 — SKILLFULNESS: More practice, doing it one's own way, deviating from the norm, taking risks, creativity, branching out. Typically, taking lessons and reading appear here for the first time with the majority of the participants agreeing.
- STAGE 5 — REFINEMENT: Automization or becoming second nature, creativity, learning new methods, strong satisfaction.
- STAGE 6 — MASTERY: Increased creativity, broader application, teaching it, continuing improvement (or dropping the activity). In Figure 1 the instructors' group has no Step 6, but they have included Step-6-type of items in their Step 5 ("teach others," "seeing cosmic connections"). As noted above, whenever a group has fewer than six steps we see this type of telescoping of items.

Finally, with the group as a whole, I ask what happened at the beginning of their learning process. I write all their answers verbatim and without comment (except to clarify a point if necessary) on the chalkboard. When they have no more to say for this first part, I ask whether they are done with this part; when they say they are, I assure them they can add more later if anything else comes to mind as we go along. (Samples of the usual four to six stages are shown in Fig. 1.) If someone objects to an item on the board — even if everyone but the originator of it objects — I leave it on the board but add a question mark.

Then I ask what they did next ("Was there another stage after that?") and, again, write verbatim what they report. This continues, stage by stage, until they say there are no more stages. Sometimes someone asks how many stages there are; my answer is that they are going to tell me.

When they are finished I ask, "Is this the way you learned your skill more or less, but more rather than less? Are there any changes or additions you want to make so that it represents the learning process you went through?" Then I read through the stages, which had been numbered as we went along, and invite them to

fine-tune the stages so they fit their own experience as exactly as possible. Sometimes they will agree a particular item was present for all the stages (e.g., practice), so a horizontal arrow is drawn across all the stages. Also, I make the point that, as some participants have said, the stages actually flow into each other rather than one stage stopping and then the next stage starting.

This part of the informal research/orientation is not complete until everyone can sincerely agree this is more rather than less how he or she learned the skill. (Only one person of the approximately 1,000 who have participated in this research said he did not learn his skill at all by this process.)

My comment now is, "You learned all these different skills pretty much by this same process. Well, this is the learning process for members of our species. This is the natural human learning process. Since all of you are able to learn to this highest stage, all of you are very intelligent and your minds work perfectly. You can be assured that you are all capable of learning anything to the highest stage when you learn by this natural process." Needless to say, this is highly motivating for students, supporting or strengthening their self-esteem and confidence.

For every group of faculty and for every group of students, whether developmental or advanced, which has participated in this research, all have had four to six stages similar to the ones shown above. When there are four stages, it is easy to see the telescoping of six.

On the basis of this data — and similar data from hundreds of other classes and groups—it seems the natural human learning process has approximately six

stages, which might be summarized (Fig. 2) though you can make your own summary of the data presented here or of data from your own students.

Perhaps we can agree, if only for the sake of argument, that this is the natural human learning process. This means that critical or high level thinking for a new topic, idea, or skill is possible only after stage 3, after their having done some sufficient amount of direct, personal, hands-on/written trial-and-error practice.

One of the most important insights we gain from this data is that essentially people learn by making and correcting (with helpful, supportive feedback from peers and teacher) their OWN mistakes. Both teachers and students must come to see and value the making of mistakes by learners. "That was a good mistake! It helps you learn because now you can see what you did wrong and have a better idea of the right way to see or do it." One of the greatest obstacles to learning is fear of making mistakes — which is the same as saying we fear the main thing needed for learning!

From the data it seems there are sequential stages of development in the learning of new skills and ideas, with higher stages following stage by stage from the preceding ones. To get to the higher ones, a person must first go through the lower ones.

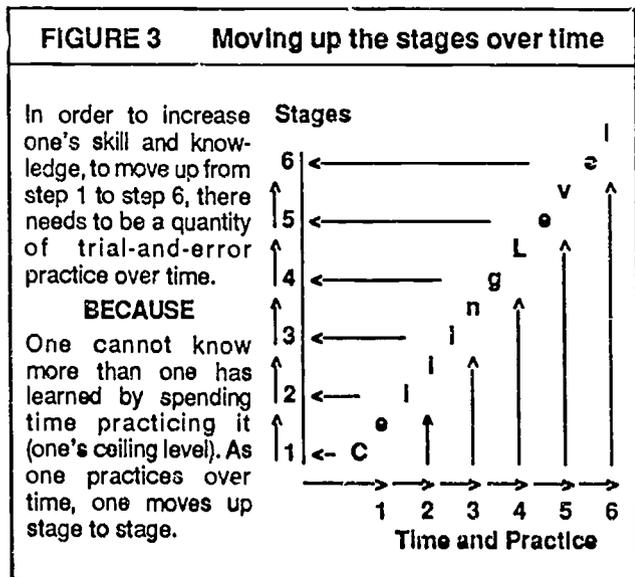
These six sequential stages can be diagrammed (Fig. 3) (and I draw the following diagram on the chalkboard), starting from the bottom at stage one and working up to stage six. To clarify, this is the natural learning process for acquiring any and all new skills or ideas (not advanced study and not information that is to be memorized by rote).

Except for people with a special aptitude for a particular topic (the aptitude known by their learning something new more quickly and easily than others), learners can't start to creatively apply or think critically about or control or generalize a new skill or idea (at stages 4 to 6) until and unless there has first been a sufficient quantity of personal practice and trial and error learning (at stages 1 to 3). In other words, there seems to be a practice and time factor in learning.

Some clear implications are evident for instruction here. For example, when teachers, who are themselves at stage 6, lecture or assign readings at any level beyond the students' "ceiling level," the material will be over the students' heads (over their ceiling level).

The only students who can be expected to be high achievers in this situation are those few to whom the

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NATURAL PROCESS OF LEARNING

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subject is not new and/or who are very highly motivated, extremely persevering, and have excellent study skills. All the other students can be expected to be lower achievers, through no fault of their own. One way to prevent this problem is to provide students with an opportunity to learn naturally so that they can all reach the stage where critical thinking naturally occurs in the learning of a new topic, idea or skill.

That is, it helps students learn by their natural learning process when we give them opportunities (at stages 1-3) to practice doing or using the new idea or skill, making — and learning from — their own mistakes, rather than our telling and demonstrating while they merely listen, watch, and read. In other words, teachers cannot simply give their knowledge to students. Students must actively practice and learn from their own mistakes if they are to develop their own knowledge and skill to a high enough stage to do creative and critical thinking about that new idea or skill. At stages 4-6 students can first begin to benefit from teachers' lectures, because by then they will have a foundation of their own real understanding, which is a prerequisite for making authentic, critical sense and use of lectures and readings.

Research clearly shows — as does our experience — that students do not naturally transfer or generalize knowledge. Thus, if we want them to know something, it is that thing precisely that they must have the opportunity to practice through the six stages.

One way to begin a new topic (at stage 1) and at the same time ascertain the class ceiling level about the new topic, is to ask the students to write individually for a few moments on the question, "What do you know about [the topic]?" Then, as described earlier, we would have them, in groups of three to four, share and discuss what they know.

Finally, we would debrief them as a whole group, asking "What did you come up with?", writing their points verbatim and without comment on the board. When we finish we will have on the board an "x-ray picture" of the knowledge level of the class. A great instructional benefit of this procedure is that students are actively involved — in their writing, and in talking in small and large groups. Research shows that active student involvement is highly effective for learning. For this reason, I teach almost exclusively in this three-step sequence of individual task, small group sharing/discussion (where a great deal of powerful learning goes on), whole group debriefing. In almost every class I share the information in this paper with my students. Whenever they begin a new unit and, of necessity, fall back to stage 1 for the new unit, I remind them of how the human mind naturally acquires new knowledge — stage by stage (active, trial-and-error) stage from 1 to 6 for every new idea or skill.

If this is the natural learning process, and if people can learn to high levels of critical and creative thinking by this process, then all intellectually and emotionally unimpaired students will be able to do critical thinking in every class in which they have the opportunity to be actively involved in the natural learning process. ▲