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Baker: Socratic Method for Teaching Problem Solving

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SOCRATIC METHOD FOR TEACHING PROBLEM SOLVING

Shirley A. Baker¹

Abstract: During the last decade, educators have been repeatedly challenged by employers to assist students to develop problem solving/critical thinking skills. Employers must be able to analyze, synthesize, and evaluate processes, products, and human interaction situations. This **article** presents one method whereby health occupations students may **acquire** critical thinking skills, namely the Socratic method or questioning technique. A modification of this technique allows the student to analyze the problem in reverse order so that the last step performed is the first discussed and evaluated. The basic elements involved in problem-solving and questioning are reviewed also.

During the fifth century B.C., Socrates developed a unique method for learning known as elenchus, which means to examine, refute, or put to shame. Socrates believed teaching was an impossible task; hence, one must become a facilitator of learning. Recognition of the value of experiences acquired through inquiry into phenomena led to what is known today as the Socratic dialogue (Seeskin, 1987). In other words, Socrates founded the art of effective questioning.

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Many academic disciplines have incorporated this teaching method, but few have used it as extensively as law schools. Socratic dialogue has long been recognized as the best method for training new lawyers to critically think through the problem, defense, and possible rebuttal, thus "refute" (Caulley, 1986). In today's high technology market, allied health occupations educators also must assist students to develop critical thinking skills.

Socrates believed inquiry or questioning had two purposes: (a) to seek a solution and (b) to reveal ignorance or "put to shame" (Seeskin, 1987). For allied health education purposes, seeking a solution is the goal for teaching problem solving skills. Questioning, therefore, provides a means for examining (elenchus) the situation or problem. As a student analyzes and processes information to form a response to the question posed, an awareness of the depth, or lack, of knowledge is acquired. In essence, a quick self-examination has taken place. "Nothing is so necessary as self-examination to show what we really know and what we only think we know" (Zeller, 1962, p. 122).

The ability to consider carefully and then acknowledge one's own ineptitude leads to the development of maturity and responsibility. A student is more likely to correct weaknesses revealed through self-examination than those identified by the instructor's written or verbal evaluations. The former situation provides an opportunity for the instructor and student to become teammates, whereas, the latter tends to put them on opposing sides.

Problem-Solving

The first step in solving problems involves clarification, "Exactly what is the problem?" The problem must be clearly identified

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so that student and instructor are working toward the same goal. Even though this may seem trite, the student possibly may not perceive the true problem or thoroughly communicate the nature of the problem to the instructor. Therefore, common agreement of the problem and its special circumstances at the beginning of the problem solving endeavor saves much time in the long run. Next, the problem must be analyzed (Illinois State Board of Education, 1985). Basically, there are two ways to do this. The traditional method is to have the student recount all performance steps from start to finish or to the point where the problem is identified. This method is especially effective for the less experienced student or special needs student. It also is very effective in reviewing human interactions or counseling situations as depicted in Example 1.

Example 1: Using a Recitation Questioning Technique

The recitation questioning **technique** may be used for teaching purposes as shown in the following manner.

Situation: Sue is a medical assisting instructor who supervises Joe, a student. Sue has just observed Joe handling a situation where a man and woman have asked for a pre-marital blood test. Joe concluded the interaction with "I'll have those results for you in 20 minutes."

Sue: How did they approach you?

Joe: The man, Mr. Smith, walked up and asked if he and his fiancée could get a blood test so they could get married.

Sue: What else did he say?

Joe: He wanted to know if it would show his blood type.

Sue: And what did you say at that point?

- Joe: I said, "No, **pre-marital** blood tests detect syphilis."
- Sue: How did **he** react to that?
- Joe: Well, come to **think** of it, he did look a little shocked and pale. Do you think he has syphilis?
- Sue: I don't know. The point I'm trying to make is that you could have handled that better. What could you have said?
- Joe: I guess I could have told him it was merely a legal requirement, just one to help the government keep track of individuals who might have a particular illness.
- Sue: Good . Now, let's pretend he does have syphilis- What are you going to tell him when he wants his results in 20 minutes?
- Joe: Oh, I didn't think of that.
- Sue: What should you have said?
- Joe: How **about** "Your results will be given to the doctor this afternoon. He will discuss them with you. Can you come back in one hour?"
- Sue: Very good!

One alternative method is to have the student explain each performance in reverse, starting with the last step performed when the problem occurred. This process requires much more concentration which tends to permanently embed the performance steps in the student's memory. At appropriate points, the student should be asked, "How would you evaluate your performance of that step?" The student mentally evaluates the procedural step and technique that was used and verbally explains the evaluation to the instructor. If the evaluation was aPProPriate **and** the procedural step was performed correctly, then this

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questioning process continues until the student reaches the step where the problem developed as illustrated in Example 2. At that time, the student should **respond** with a negative evaluation statement when determining the correctness of the performance. If this is not the case, then the instructor must use probing questions to encourage and guide more critical thinking.

Example 2: Applying a Reverse Order Questioning Technique to Problem Solving

The reverse order questioning **technique** can be used in a teaching situation to assist the student in the following manner.

Situation: Tom, a medical laboratory technology instructor, has just been approached by Jean, a clinical chemistry student. She **appears** perplexed about her laboratory procedure results for glucose.

Jean: I have a problem.

Tom: What exactly is your problem?

Jean: My normal control for the glucose procedure is reading too high.

Tom: Let's review what you have done. First, in detail, what was the last step you performed?

Jean: Well, I took the absorbance readings and did my calculations.

Tom: How did you calculate your value?

Jean: I put the absorbance of the control over the absorbance of the standard times the concentration of the standard.

Tom: What did you do to obtain your readings?

Jean: I took the tubes out of the cooling water and dried them off. Then when they were room temperature I wiped them with a

lint-free wipe and put each one in the **spectrophotometer**

well. I put **the** cover on the well and read the absorbance.

What were your absorbance readings?

Jean: I got .25 for the standard and .55 for my control.

Tom: How would you evaluate those readings?

Jean: Well, the standard read correctly, according to the procedure. The control just read too high.

Tom: What do you think might be the problem?

Jean: I guess I did the procedure correctly or the standard wouldn't read within range. Maybe there was something wrong with my control. I made up fresh control, though. I put 10 ml . . . **uh, oh.**

Tom: **Uh, oh, what?**

Jean: I only put 5 ml of distilled water in my control. It was supposed to have been 10.

Tom: (Smiling) At least you have learned how to analyze and solve your problems. I doubt if you make that error again.

Even though the process of examining the performance in reverse sounds time consuming, it actually takes very little **time**. Once the student becomes aware that this will always be the protocol, more initiative will be taken to identify and analyze problems. This reverse process usually shortens the questioning time because the student tends to make most errors in the final steps of a procedure due to increasing levels of complexity and time constraints.

The instructor should avoid answering a question before the student has a chance to respond as **portrayed** in Example 3. If the student says, "I don't know," the question should be rephrased so as

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to break down the information into smaller packets or into a series of lower level thinking processes. **The** student should then be asked to read information sheets or the procedure again. Then, the question would **be** restated. **Once** again, **the** instructor should refrain from answering the question for the student. Rarely will a student not know any part of an answer.

Example 3: Using a Probing Questioning Technique

The instructor can use the probing questioning technique to assist the student in the following manner.

Situation: Britt is a dental assisting student who has just presented Lea, the instructor, with some radiographs. They **are** reviewing them to determine the problem.

Lea: Why do you think these films are so dark?

Britt: I guess I did something wrong.

Lea: What exactly do you believe you did wrong?

Britt: Well, probably the **kilovoltage**, current, or exposure time was wrong.

Lea: Good thinking. Now, how could those factors make the film darker?

Britt: Excessive voltage produces dark films and so does too much current or too long an exposure time.

Lea: Great ! Will anything else affect the darkness?

Britt: I don't think so.

Lea: What happens to the film once it is exposed?

Britt: I develop it. Oh, yeah, it might be overdeveloped!

(Illinois State Board of Education, 1985)

Lea: Very good!

The third step in solving a problem is to examine **all** possible solutions. In some cases, there are no alternative solutions. The problem resulted from poor technique (e.g., improper **pipeting**) or from human error, such **as** failure to set the proper exposure time for a radiograph (Illinois State **Board** of Education, 1985). Problems of these **types are** easily identified and remediated. Difficulty develops in solving the higher order thinking skills which involve judgment decisions. Often such decisions must be made based on a combination of knowledge, experience, and ethics. The student should be encouraged to integrate different sources of information in order to develop as many feasible solutions as possible (**DeCosta**, 1986).

Lastly, each alternative solution must be evaluated by the student and one solution must be selected for implementation (Illinois State Board of Education, 1985). At this point, the instructor should question the student's rationale and reason for that particular selection. Questions should be phrased so as to allow the student to examine and understand underlying value systems and decision making processes (**Trachy**, 1983).

Questioning Technique

The questioning technique is very appropriate in clinical/laboratory situations. It is particularly effective in cases in which a problem has developed in the course of the procedure. When the student asks, "What's wrong?," the instructor has a golden opportunity to elicit critical thinking through thought provoking questions.

Questions should **NOT** be asked in an intimidating, authoritarian, or accusative tone of voice. Also, the instructor should be aware of body **posture** when posing a question. Furrowed brows, a scowl on the

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face, hands on the hips, and other gestures nonverbally communicate impatience and frustration with the student. The student may even feel "stupid" for having a problem in the first place, much less not being able to solve it **alone**. All questions posed for teaching purposes should be discreetly asked away from the patients.

The Socratic or questioning method requires the instructor to patiently wait **at least** three to five seconds for **a response** before rephrasing the question. This allows the student time for recollections, analysis, and synthesis of a response, or evaluation of a performance. When the student does respond, it is of the utmost importance that the instructor truly listens without interrupting (Dillon, 1983). A solution developed in this manner greatly enhances the student's self-esteem.

When a student answers **a** question correctly, positive reinforcement should **be** given by verbal praise, a nod of the head, a smile, a pat on the back, or some other appropriate feedback. Most educators are conditioned to do this. On the other hand, when an incorrect response is given, the instructor should refrain from negative statements such as "No, 'chat's not right" but rather use a response such as "Think carefully" or "**Think** it through again," In this way, the student feels the response can still be rectified without losing face. There are so many rules and regulations in an individual's life which say "No, don't do **that!**" that in order to teach critical thinking skills, positive statements and probing questions must be used to encourage students to continue trying. As always, praise for **a** problem-solving job well done provides the finishing touch for a satisfying experience for both student and instructor (Wilten, 1987) .

Advantages for Using Nonthreatening Questions

There are many advantages for using skillful nonthreatening questions. These may include, but are not limited to, the following:

1. Students are more motivated and learn more on their own (Brinton, Jarvis, & Harris, 1984; Illinois State Board of Education, 1985).

2. Students learn necessary skills for analyzing and solving problems (Illinois State Board of Education, 1985).

3. Both student and instructor experience feelings of success (Brinton, Jarvis, & Harris, 1984; Illinois State Board of Education, 1985) .

4. The student's self-esteem is raised (Illinois State Board of Education, 1985).

5. Students develop judgment and evaluation skills (Dillon, 1983) .

6. Previously learned material is recalled and concepts are applied (Illinois State Board of Education, 1985).

7. Students are more interested and actively involved in learning (Brinton, Jarvis, & Harris, 1984; Illinois State Board of Education, 1985) .

8. Interaction with the faculty is improved (Brinton, Jarvis, & Harris, 1984).

9. The instructor gets immediate feedback on any knowledge or skill deficiencies individual students may have (Dillon, 1983).

10. Students begin to believe in their own problem solving skills to the extent that their new found self-confidence will allow them to solve problems without assistance or assurance from the instructor (Illinois State Board of Education, 1985).

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Discussion

Clinical and laboratory teaching are especially suited for application of the Socratic *method* (Tibbles, 1981) and may be used successfully in health occupations programs. The interaction in these situations tend to be more one-on-one or small group, both of which lend themselves to the questioning *technique*. Students, who are most interested in this technique of learning, are identified as intuitive-feeling types by the Myers-Briggs Type Indicator (Brinton, Jarvis, & Harris, 1984).

The Royal College of General Practitioners (1972) determined that all clinical teaching could be divided into four groups. One of these groups was the Socratic method; another was the counseling style. "Both of these groups share a common philosophy of existentialism which promotes the human existence primary to all else and, therefore, reasons learning begins with self and riot with knowledge" (p. 446). Students are challenged by and committed to the Socratic teaching style as a result of their internal desire to learn. They are motivated by the need to find within themselves the solutions to their problems. In this regard, the wisdom of Socrates remains relevant for today. According to Zeller (1962):

Socrates maintained that without right knowledge right action is impossible, and conversely, that where knowledge exists, right action follows as a matter of course. . . , The main point then invariably is to cultivate this disposition by education. Some may bring with them more, others fewer gifts for any particular activity; yet all alike require exercise and training. . . (pp. 142, 146).

Health occupations education programs face increasing challenges to teach more material at a greater complexity level in the same time frame as two decades ago. Teaching must become ultra-efficient to accomplish this task. Questioning provides a method for both teacher and student to evaluate the thinking process and the level of learning acquired. This technique is very effective at the secondary, **postsecondary**, and collegiate levels. An art form to be mastered, the questioning technique is easily modified to address a variety of situations, subjects, and audiences. Ultimately, the Socratic method benefits students and teachers.

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