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REVIEW ARTICLE

Is problem-based learning an ideal format for developing ethical decision skills?

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Abstract Ethical decision making is a complex process, which involves the interaction of knowledge, skills, and attitude. To enhance the teaching and learning on ethics reasoning, multiple teaching strategies have to be applied. A medical ethical reasoning (MER) model served as a framework of the development of ethics reasoning and their suggested instructional strategies. Problem-based learning (PBL), being used to facilitate students' critical thinking, self-directed learning, collaboration, and communication skills, has been considered effective on ethics education, especially when incorporated with experiential experience. Unlike lecturing that mainly disseminates knowledge and activates the left brain, PBL encourages "whole-brain" learning. However, PBL has several disadvantages, such as its inefficiency, lack of adequately trained preceptors, and the in-depth, silo learning within a relatively small number of cases. Because each school tends to utilize PBL in different ways, either the curriculum designer or the learning strategy, it is important to maximize the advantages of a PBL session, PBL then becomes an ideal format for refining students' ethical decisions and behaviors.

Introduction

In order to help students learn in the three domains, i.e., cognitive knowledge, psychomotor skills, and affective attitudes/values, medical educational curricula have evolved through several major reforms. The evolution of educational experiences includes the curriculum of apprenticeship, disciplinary, body systems, case-based clinical models, and clinical presentation models [1]. Lecturing was the predominant teaching strategy in the discipline and system-based curriculum, and students were often overwhelmed by vast amount of disjointed medical knowledge. The problem-based curriculum has been developed to overcome the above disadvantages. Besides the acquisition of knowledge, problem-based

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learning (PBL) is to help foster clinical problem solving skills and critical thinking ability, to enhance self-directed learning, and the interest and motivation to learn, plus the interpersonal and communication skills. After years of "overreaction" to correct the disadvantages derived from the lecture-based models, the educational "pendulum" has again swung more to the center of the two extremes of learning strategies (on the lecture and the PBL). In the most recent clinical presentation curriculum, multiple learning modalities are provided, such as lecturing, reading, modeling, demonstrating, discussing issues in small/large groups, independent learning, eLearning (internet), simulating, computer assisted learning, reflecting, completing assignments, Socratic teaching, working on projects, critical appraising, and researching. Each instructional strategy has its advantages and disadvantages relative to the student/objective/content being taught. The domain and learning objective determine the most appropriate instructional strategy for a teacher to use. The best learning strategies are then selected on the basis of learning objectives and the background of the learners.

Discovery vs. guided learning

The instructional strategies and the corresponding philosophy can be generally divided into two broad categories: discovery and guided learning. Disputes over the impact of each instructional strategy have been occurring over the past 50 years. There were those who argued that students learn best in an unguided environment—where they must identify the concepts to be learned, abstract the information from available resources, and utilize the information in problem resolution [2–4]. By contrast, there were those who argued that students should be provided with direct instructional guidance on the concepts and procedures required by a particular discipline and should not be left to discover those procedures by themselves [5–8].

In student-directed (discovery) learning, the student is made responsible for engineering/creating their learning experience with minimal guidance from the teacher. Medical students in case-based curricular model are asked to discover solutions to common patient problems using PBL [9,10]. They learn both the basic and clinical knowledge related to a case in an integrated manner. They are self-directed learners who are encouraged to prepare for the classes. In direct instructional guidance, the teacher provides the information that fully explains the concepts and procedures that students are required to learn as well as selects the learning strategy that maximizes learning for the student. The degree of explanation and organization of concepts can vary by curricular models. For example, in the disciplinary model, the basic sciences come first, followed by the clinical sciences. In the clinical presentation model developed at the University of Calgary, the curriculum is defined by 120 units of clinical presentation (i.e., chief complaints/manner a patient presents to physicians). Students are taught the basic and clinical science concepts within each clinical presentation and are provided with mental scaffolding (i.e., scheme) that reflects the knowledge structure and cognitive strategy used by experts in solving clinical problems [11]. The basic and clinical sciences are taught in an integrated manner within each clinical presentation. Thus, the degree the knowledge is discovered and the degree of integration of basic to clinical sciences within each curricular model can vary significantly.

Kirschner et al. [8] presented a convincing argument why extensive use of minimal guidance (e.g., PBL) within curricula does not work. The study argues against discovery/minimal guidance learning based on the current understanding of human cognitive architecture, expert-novice dissimilarities, and the management of cognitive load (sensory input). In their study, several research findings indicate that minimal guided instruction is both less effective and less efficient than guided learning. Furthermore, whenever medical schools use an extended amount of unguided/discovery learning, it inevitably is followed by a heavy dose of guided instruction if students are required to pass a national competency examination. Harasym et al. [12] made the same argument regarding the development of critical thinking abilities in medical students. In this study, it was argued that the most efficient instructional method to develop student critical thinking abilities and medical expertise is through guided (not discovery) learning. Yet, PBL (discovery learning) has many advantages that cannot be ignored. For example, PBL: optimizes student-centered/student-directed learning; focuses on problem-solving using real patient cases; initiates brainstorming, discussions, and identification of learning issues; enhances interest in subject matter; integrates student learning in the context of basic and clinical knowledge; promotes social interaction, team work, self-assessment, and reflection; and is an ideal strategy for professional (attitudinal) development. The central issue is why a case-based curriculum is inefficient yet PBL is a useful learning strategy in developing student's ethical decision making skills? Answers to these questions are important for a better understanding as to why some medical schools have retained their curricular (disciplinary/body systems) model while interspersing PBL throughout the student learning experience. Here, we examine a study that compared two instructional strategies for teaching ethics (PBL vs. Lecture) [13].

PBL- vs. lecture-based education on medical ethics

Lin et al. [13] reported an investigation that compared PBL and lecture instructional strategies in teaching ethics in nursing. They used a pretest posttest design and randomly assigned 142 nursing students to either the PBL or lecture instructional modality. By assessing students' degree of learning satisfaction, they found no difference in pretest mean scores between the two groups, whereas there was a significant increase in posttest mean scores for the nursing students within the PBL group (PBL = 3.65 and lecture = 3.58). There was also a significant difference in student learning satisfaction scores for items of critical thinking and self-motivation (PBL = 3.99 vs. lecture = 3.67 and PBL = 3.92 vs. lecture = 3.59, respectively). However, there were no differences in satisfaction level in teaching method, moral self-cultivation, understanding ethical

issues, or intellectual stimulation. They concluded that peer-tutored PBL has the potential to enhance the efficacy of teaching nursing ethics, where there are personnel and resource constraints.

Although it is noteworthy that PBL did make a statistical difference in mean scores, one must ask if the difference of 0.07 within the group (3.65 vs. 3.58) implies that it is significantly different. In addition, the study begs the questions of the utility of comparing two instructional strategies of PBL and lecture.

Koh et al. [14] reported a meta-analysis of 13 studies that evaluated the physician competencies obtained from traditional or case-based curricular models. They examined studies that reported findings in one of eight dimensions within physician competencies: overall, technical, social, cognitive, managerial, research, teaching, and knowledge. Of the eight dimensions, they found a significant difference in only the social dimension. In this dimension, they found four out of eight areas in which the students educated within the case-based curriculum were stronger in teamwork skills, appreciation of social and emotional aspects of healthcare, appreciation of legal and ethical aspects of healthcare, and appropriate attitudes toward personal health and well-being. However, the majority of competencies (overall, technical, cognitive, managerial, research, teaching, and knowledge) were found to be either equal or weaker in students that were educated with the discovery learning case-based curriculum. Their findings are equivalent to other meta-studies comparing physician competencies in case-based vs. discipline or body-system curricula [15,16]. Nevertheless, it is important to understand why PBL is effective in developing abilities related to the social dimension, specifically group activities and the legal and ethical aspects of healthcare.

Findings from meta-analyses are convincing. Research in medical education helps to improve curricular models and the instructional strategies used. Comparing two instructional strategies is perhaps not the best research question to ask. Perhaps it is better to focus on research that asks what combination of instructional strategies (tools) will enhance learning outcomes within different students. For example, assuming that a study was designed to investigate the advantages and disadvantages of two tools used to build a house, the research question could be which tool is better, a saw or a hammer? Obviously, this research question is inappropriate because each tool was designed for a different purpose. You would not use a hammer to cut a board nor a saw to hammer a nail. Likewise, the instructional strategies of PBL and lecture are designed for different purposes. In education, just as in the construction industry, it is important to understand the purpose of using each tool so that the tool is used effectively [17—21].

Ethics decision making

In order to understand why PBL is an effective instructional method for developing student ethical behaviors one must look into the nature of ethical dilemmas, the principles that guide ethical decision making, and how attitudes and values are developed within students. There are several principles that guide ethical decision making: autonomy, beneficence, justice, dignity, nonmaleficence, and truthfulness/honesty [22]. All of these principles must be valued by the physician in order that appropriate behaviors are selected. For example, let us look at the principle of beneficence. Owing to the nature of the relationship between physicians and patients, doctors do have an obligation to: (1) prevent and remove harm, and (2) weigh and balance possible benefits against possible risks of an action. Beneficence can also include protecting and defending the rights of others, rescuing persons who are in danger, and helping individuals with disabilities. The willingness to behave in a beneficiary manner is highly dependent on having the right values and attitudes. Attitudes and values guide our perceptions and our behaviors. But how are they created?

The development of ethics behaviors

The components underlying learning involve three domains: cognitive, skills, and attitude, and each has a hierarchical developmental structure. Bloom [23] created a hierarchical structure in the cognitive domain: recall (knowledge), comprehension, application, analysis, synthesis, and evaluation. Simpson [24] created a structure in the psychomotor domain: observing, imitating, practicing, adapting, and originating. Likewise, Krathwohl et al. [25] created the hierarchical structure in the affective domain: receiving, responding, valuing, organizing, and characterization. There are five steps and two to three substeps within the hierarchical. As honesty and trust are important bases for ethics justification, an example of their developmental sequence is given as follows:

(1) Receiving
   (i) Awareness: Aware of the concepts of honesty and trust.
   (ii) Willingness to receive: Occasionally listens and observes messages reflecting honesty and trust.
   (iii) Controlled attention: Pays attention to messages describing outcomes when honesty and trust are violated.
(2) Responding
   (i) Acquiescence in responding: Is honest and trustworthy when told to do so.
   (ii) Willingness to respond: Voluntarily behaves in a manner reflective on honesty and trust within select situations.
   (iii) Satisfaction in response: Tends to be rewarded for displaying behavior reflective on honesty and trust.
(3) Valuing
   (i) Acceptance of a value: Desires to be honest and trustworthy in the majority of situations.
   (ii) Preference for a value: Tends to associate with others who are likely to be honest and trustworthy.
   (iii) Commitment: Adopts a positive attitude towards being honest and trustworthy in most situations.
(4) Organization
   (i) Conceptualization of a value: Develops a clear rational as to the value of being honest and trustworthy.
   (ii) Organized value system: Has a clear understanding of the importance of being honest and trustworthy,

willing to identify abusers, and knows who to inform regarding unprofessional practice.

(5) Character
   (i) Generalized set: Feels it is immoral and unethical to not be honest and trustworthy.
   (ii) Characterization: Develops an internal structure about the appropriate ethical behaviors consistent with his mental, spiritual, and philosophy of life.

Development of attitudes and values begins as a child and continues throughout life. Their development is complex, evolves over time, and is heavily influenced by parental attitudes and values. Take the following example: the phone rings and a mother asks her 6-year-old child to answer the phone. The child responds, "Mom, it is Uncle Mark." The mother, says, "Oh dear, I'm busy now. Tell him I'm not in." In a subtle manner, the mother may be teaching the child that lying is OK. Further, attitudes and values are difficult to self-assess and alter. Are you honest or are you honest to a certain degree? For example, let it be assumed that you are walking on the street and you see a lady in the distance who accidently drops a bag. What would you do if you walk up to the bag, opened it, and saw that it contained: $100 NT?; $1000 NT?; $10,000 NT?; $100,000 NT?; $1,000,000 NT?; $10,000,000 NT?. Let us now assume that the average salary of a Taiwanese is $30,000 NT, you lost your business, are in debt almost $45,000 NT, have a spouse who is unemployed, and have two children who wish to go to university. What would you do now—give the money back or decide to keep it? Does the amount in the bag influence your decision? Furthermore, let us assume that you had heard on the radio that there was a robbery, a lady walked away with a bag full of money, and the money was insured? What would be your threshold to reporting the monies to the police or keeping it? In other words, one may be honest, but the context may cause them to bend their values and attitudes according to the demands of the presenting situation/circumstances.

Teaching and learning in ethics

Ethical values are a deep rooted character that takes time and effort to become part of one's inner character. The proper evolution/development of ethical values is one problem, but altering them in order to have physicians respond in an appropriate manner is even more difficult. Philosophers, throughout the ages, have argued whether ethics (virtue) can be taught. For example, consider Plato's memo (70a) [26,27]: "Can you tell me, Socrates, is virtue the sort of thing you can teach someone? Or is it the sort of thing no one can teach you, but you pick it up by practicing it? Or maybe it's neither: virtue is something people are born with, or something they get some other way?" The confusion regarding how to best develop appropriate ethical values still appears to exist, but most educators would certainly agree that it can be taught. Unfortunately, there are limited numbers of instructional strategies to help the learner to receive, respond, organize, evaluate, internalize, and realign their ethical values. Part of the difficulty occurs because students find it difficult to know what their attitudes and values are. Thus, it is necessary to present different clinical scenarios to challenge/activate student's attitude and values—to bring them forth for evaluation. It is only when students consciously evaluate their ethical values within the context of the clinical situation that they become aware what attitudes and values they hold. Awareness is only the first step. The realignment of attitudes and values is another challenge that tends to occur through social interactions, challenges, and feedback. Knowing what the proper behavior is and what others might do in that similar situation helps students to adjust their attitudes and values accordingly. Thus, altering and properly aligning a student's attitudes and values requires proper exposure, challenges, and discussions. This process cannot occur solely through the lecture format. To properly change student attitudes and values toward ethical professional behaviors, we suggested to choose the most appropriate instructional strategies based on an ethical educational model—medical ethical reasoning (MER).

Tsai and Harasym [28] published an article titled "A medical ethical reasoning (MER) model and its contributions to medical education." It describes the MER model and indicates how it can be used to foster moral and ethical behaviors. MER was created on the basis of the information derived from two sources: (1) examining different ethical models described in the literature; and (2) think-aloud interviews of medical ethical experts in Taiwan and Canada. The MER model is shown in Fig. 1.

The MER model has three components: knowledge, skill, and attitude. When an ethical dilemma is presented to a physician, both medical and ethical knowledge are activated (Step 1). The initial primary concern of the physician is to understand the nature of the medical problem. When the medical problem is clarified, the physician proceeds to consider the ethical aspects of the case. Thus, there are four basic steps in the skills component of the model: (1) problem identification and information gathering; (2) decision making; (3) planning for treatment and management; and (4) observed clinical behaviors. The fourth step can be greatly influenced by the individual and context factors (e.g., conflicts, nature of family support system, and available resources). Thus, while making ethical decisions, experts identify the most appropriate medical intervention,

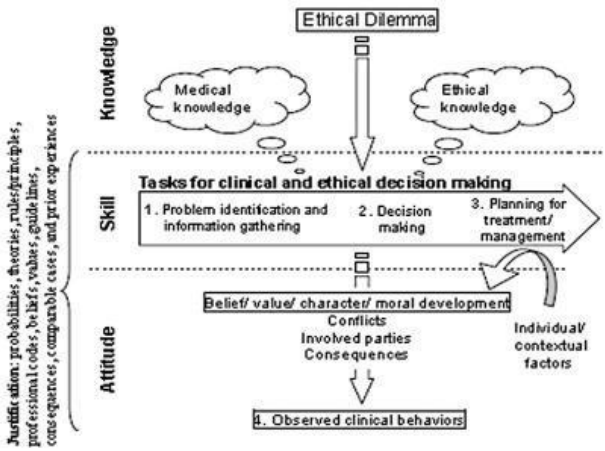

Figure 1. Medical ethical reasoning model.

which can be altered by contextual factors, including the preferences of the patient/family and the most likely consequences and quality of life. Justifications for medical and ethical decisions are based on a variety of factors: probabilities, theory, rules/principles, law, professional codes, beliefs, values, guidelines, consequences, outcomes of comparable cases, and prior experiences. The model provides a framework to foster understanding of ethical reasoning and to help create optimal learning experiences.

Each of the three domains is interdependent and can be taught using the most appropriate instructional strategy. For example, medical and ethical knowledge can be taught by lecture or learned by reading appropriate references. There are books that present core ethical clinical cases: for PBL and self-assessment [29], and books such as "Core Clinical Cases: Questions and Answers in Medical Ethics" [30] are also useful reading resources. In the MER model, the identified skills can be learned through small group problem-solving sessions, assignments, observations, and case studies. Alignment of attitudes and values can occur through experiential learning (dealing with a real ethical dilemma under the watchful eye of a supervisor), role playing (seeing the world through the eyes of the patient), and small group discussions. PBL is an excellent/ideal format for refining the steps in all three domains. In other words, armed with core knowledge, skills, and attitudes, students professional/ethical behaviors can evolve through challenges encountered in different cases.

Kobl's experiential learning cycle (Fig. 2), coupled to the MER model, can be used to enhance ethics performance. After an ethical decision has been made [(1) ACT], Kobl's cycle recommends three additional steps: (2) reflect (evaluate the consequences and determine if desired outcomes were reached); if no, then (3) conceptualize (determine how to improve the outcomes and gain new insights in knowledge, skills, and attitudes); and (4) apply (use new insights to the next dilemma). The use of Kobl's experiential learning cycle emphasizes the importance of giving students ample opportunities to resolve different ethical dilemmas [31].

Ethical problems tend to be complex and they do not often have a clear-cut solution. Thus, challenges, discussions, and experiential learning are important: to help learners clarify their attitudes and values, to identify the key influencing factors, and to make the best decision for a given case. Multiple instructional strategies at different stages of learning can be used. However, PBL is an ideal format for helping the learner refine their understanding and improve their ethical problem-solving behavior after having core knowledge, skill, and attitudes.

To understand why PBL is an ideal instructional format for enhancing students' ethical behaviors, it is necessary to look into and understand how the human brain functions. The brain consists of two hemispheres (the left and the right) [32]. Each hemisphere has a unique mental activity as shown in Table 1.

The left side is often referred to as the rational (logical) brain and the right side as the irrational (emotional) brain. When faced with a problem or decision, the best results are generated when both sides work in harmony with each. If the membrane joining the two hemispheres are severed, then the individual is incapable of make even the simplest of decisions (e.g., "What would you like for supper?").

Both hemispheres have specialized functions and a preferred method of instruction. For example, the left hemisphere: has a preference for collecting data, solving math problems, listening to lectures, reading textbooks, judging ideas based on facts/criteria, reasoning logically/sequentially, following directions, and managing time. By contrast, the right hemisphere has a preference for listening to and sharing ideas, looking for personal meaning, dealing with uncertainty, receiving sensory input, studying in small groups, comprehending the big picture, taking initiative, being creative, answering "what-if"

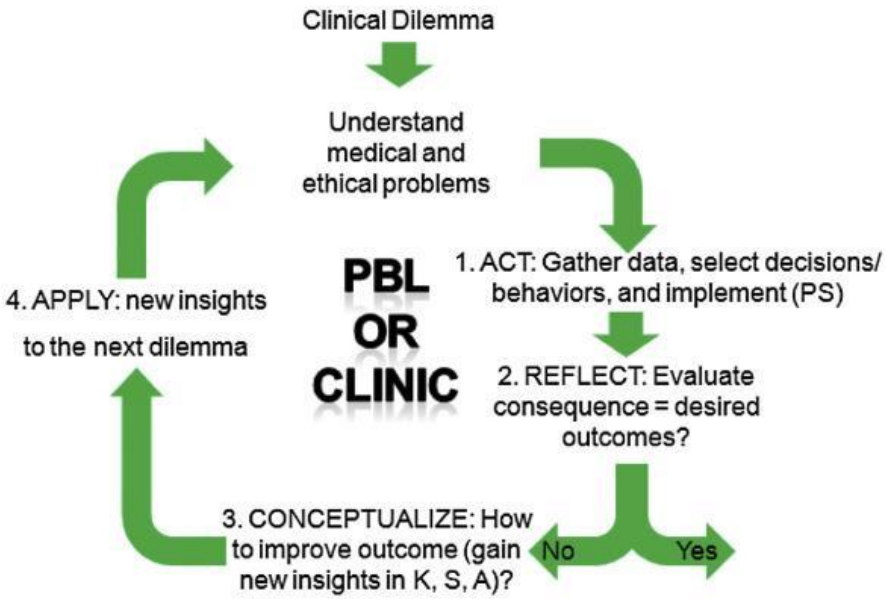

Figure 2. Kobl's experiential learning cycle applied to ethical development. A = attitudes; K = knowledge; PBL = problem-based learning; PS = problem solving; S = skills.

Table 1 Left and right brain activity.

Left brain activity	Right brain activity
Language	Emotions
Logic	Attitudes
Mathematical	Values
Sequential	Spatial
Factual	Intuition
Detailed	Holistic
Scientific	Musical
Cognitive IQ	Creative
Judgmental	Emotional IQ
Rational	Social IQ
Spelling	Attention

questions, learning from visual aids, brainstorm, and being sensitive to emotions, beliefs, values, and attitudes. Thus, from an instructional strategy perspective, the left hemisphere is more likely to be active during lectures and while reading. By contrast, the right hemisphere is more likely to active during small group activities.

The activities within the left and right hemispheres have implications for education. Herrmann [33] strongly criticized traditional educational practices as too L brain focused. In his opinion there was too much focus placed on lectures, memorizing, and logical/sequential reasoning skills. In addition, higher educational institutes that utilized aptitude tests for selecting students (MCATs, SAT, GMAT, etc.) were giving higher preference to those students who excelled in development of the activities of the left hemisphere. Unfortunately, those students who were creative, artistic, and socially oriented were less likely to be offered admission to institutes of higher learning because people tend to be left or right brain dominant. The new admission procedures that utilize both grade point averages/aptitude tests (reflective of academic ability) and the multi mini-interview (reflective of social intelligence) are designed to select students that have attained higher development of both the left and right hemispheres. Medicine is a helping profession, and thus students who are academically bright and socially intelligent are more desired to enter the profession than those students who have attained high development in primarily one hemisphere.

Clearly, teaching-learning approaches in ethical development must encourage "whole-brain" learning. Lecturing is an excellent instructional tool for disseminating knowledge and primarily activating the left hemisphere. PBL is also an excellent instructional strategy for helping students to learn how to learn and working within small groups. Activating both the left and right hemispheres of the brain is important in medical education but PBL/discovery learning strategy can be very time consuming and inefficient if used exclusively (e.g., the case-based curriculum). The instructional pendulum within curricular models should return to the center and instructional strategies should be selected based on the domain and desired learning outcomes.

In conclusion, there are three domains in medical education: cognitive, psychomotor, and affective. Each domain has a hierarchical set of steps. Development in the affective domain is complex and applications of Krathwohl's five hierarchical steps, each with two or three subcategories, help to understand how difficult it may be for students to fully embrace/develop a particular set of attitudes and values. Development in the affective domain occurs over a lifetime. Often students do not know what their attitudes and values are until they are presented with a situation that calls them into consciousness. Deciding on the most appropriate decisions helps students to identify their core attitudes and values. Without this challenge, it is very difficult for the learner to identify and alter the attitudes and values they have. Yet beliefs/attitudes/values/biases determine how we perceive the world and the kind of decisions humans make.

The MER model provides a comprehensive framework to help select appropriate educational strategies within the three domains. In professional development, students must be sensitized to their personal perceptions. Ethical reasoning goes beyond clinical reasoning because a physician with inappropriate attitudes and values may prevent an optimal ethical solution from being made. There are a limited number of instructional strategies to help the learner to receive, respond, adopt, evaluate, internalize, and modify ethical values (i.e., activates of the right hemisphere). Ethical values that are deep-rooted character attributes and that are inappropriate are difficult to change. Thus, challenges are required to help students' identify their attitudes and values. In addition, the contextual factors of an ethical dilemma can change the optimal decision to be made. Furthermore, an individual's circumstance can shift the ethical decisions made and the subtle interplay of available extrinsic and intrinsic rewards must be taken into account when teaching students proper ethical decision making. Just as in Ying-Yang, ethical teaching necessitates involving both the left and right hemispheres of the brain. Medical educators must engineer learning environments that select the best instructional strategy given the desired student learning outcomes. Ethical problems tend to be complex with no clear-cut solution. Discussions with feedback can help learners clarify their values/attitudes, identify the key influencing factors, and arrive at the best ethical decision for a given case. PBL is an ideal format for helping the learner understand, evaluate, and refine their ethical values, attitudes, and refine their ethical problem-solving behavior (left and right hemispheres). PBL/discovery learning is not a panacea for all learning. The outstanding teacher selects the best instructional strategies for the desired learning outcomes for a given group of students.

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