

Lap Ki Chan
Wojciech Pawlina
Editors

Teaching Anatomy

A Practical Guide

 Springer

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*“To my parents, Laura, and my teachers and students,
from whom I have learned much”*

Lap Ki Chan

*“To my anatomy teachers who guided me to the threshold of my
optimism: Kazimierz Pawlina, MD my father and first anatomy
teacher; Franciszek Jugowski MD, PhD from the Jagiellonian
University, Lynn H. Larkin, PhD from the University of
Florida; Stephen W. Carmichael, PhD from Mayo Clinic;
and to my past, present and future students.”*

Wojciech Pawlina

Preface

The title of this book, “Teaching Anatomy: A Practical Guide,” deserves some explanation. The word *teaching* has unfortunately become an unpopular word in educational writing. It is often associated with passive learning with the teacher playing the role of the “sage on the stage.” Knowledge is seen as packages transferrable from the teacher to the students, whose role is only to be receivers of the packages. But to us, teaching involves all activities that a teacher does to help students learn. It involves being both a “sage on the stage” and a “guide on the side.”

With the current trend toward a system-based approach to medical education, a book that focuses on the teaching of *anatomy* may seem old fashioned. After all, over the past few decades, anatomy has become increasingly integrated into the wider curriculum and is less of an isolated subject. However, this shift in the curriculum and educational philosophy has not destroyed anatomy’s long history as a distinct discipline. Anatomy, especially gross anatomy, still plays a unique role in many healthcare programs: it has frequently become the only practical course that students will experience in the early part of the medical curriculum. Students oftentimes learn gross anatomy from possibly one of the most mystical teaching aids: their first “patients,” the cadavers. Cadaveric dissection provides a unique opportunity for students to be introduced to issues of life, death, and suffering and to learn the “soft” skills of medicine. Through working together in the dissection laboratory, students learn skills like reflection, teamwork, communication, professionalism, and ethics, which are all important to their future healthcare careers.

This book aims to be a *practical guide* and not an exhaustive reference on educational theories as applied to anatomy teaching and learning. We understand that anatomy teachers work in diverse educational environments, including professional healthcare and undergraduate programs, teaching students with different kinds and levels of preparation. They may need to work within the confines of a set syllabus or designing their own course. They may have preferences for high or low tech materials and have few resources or many. Their backgrounds may be clinical or academic. They often need to convey a large body of knowledge to students in a short time and integrate it into the wider healthcare curriculum. They may need to take part in highly specialized pedagogies, such as problem-based learning, team-based learning, and e-learning. Moreover, since curriculum structures vary among schools, integrating anatomy into the curriculum must be flexibly done.

To help teachers to tackle these challenges, we edited this guide book, which gives practical advice to both novice and experienced anatomy teachers in the diverse educational situations that they commonly encounter. We are the first to admit that we do not know it all, so each chapter is written by an expert on its topic. The aim is to help teachers to give the best learning experiences to their students. We also understand that anatomy teachers, like most other teachers in tertiary institutions, need to divide their time between teaching, research, administrative duties and sometimes even clinical work. We have invited the expert authors of the chapters to write concisely and in simple language. Text boxes are provided to bring out the key points, to stimulate reflection on the reader's own situation, or to provide additional practical tips. Educational theories, though not the focus of this book, are selectively included in order to explain the theoretical foundation underlying practical suggestions, so that teachers can appropriately modify the strategies described in the book to fit their own educational environments.

As anatomy teachers, we often hope our students will gaze in awe at the inner universe of the human body, as we once did and, hopefully, still do. The induction of our students to this inner universe is a privilege for us. It deserves to be done well. We sincerely hope that this book can help you to help your students to learn. Learning should be fun. And so should teaching, especially anatomy.

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Dr. Wojciech Pawlina is a Professor of Anatomy and Medical Education at Mayo Clinic College of Medicine in Rochester, Minnesota, USA. He earned his medical degree from the Jagiellonian University Faculty of Medicine, formerly Copernicus Medical School in Krakow, Poland, where he was appointed as instructor in the Department of Descriptive and Topographical Anatomy and completed his residency in Obstetrics and Gynecology. Since 1986 he worked as a Postdoctoral Associate at the

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Part I

Teaching and Learning Anatomy

Elements of Successful Adult Learning

1

Lap Ki Chan and Miriam Uhlmann

This book is mostly about how teachers can design teaching and learning activities that engage their learners, so as to give them the best anatomy learning experiences. The activities may take many forms, in various settings, and use different methods and tools. Despite these variables, there are some common elements that may lead to better learning experiences. This chapter discusses these elements in general.

To understand the elements, it is important to know how adults learn. Adult learning theory (also called “andragogy”), in the tradition of Malcolm Knowles [1], is defined as “the art and science of helping adults learn.” It is based on four assumptions about adult learners:

1. Adults need to know why they need to learn something.
2. Adults need to learn experientially.
3. Adults approach learning as problem-solving.
4. Adults learn best when the topic is of immediate value to their training or work.

Knowles [1] contrasted andragogy with pedagogy, which he defined as “the art and science of teaching children” (note that it is different from the

general usage of the term nowadays) wherein the learners are assumed to be more dependent on the teachers in determining what and how they learn, have little personal experience to bring to the learning process, have learning needs largely determined by someone other than themselves, and are more subject centered. However, andragogy and pedagogy should be considered as two separate sets of assumptions that can sometimes be applied to learners of any age under different situations [1].

For adults to learn successfully, educational activities usually need to match their learning needs, motivate by triggering their internal drivers, provide clear goals or outcomes that they are expected to achieve, engage through active learning, stimulate reflection, and create connections with existing experiences. One element that is missing in adult learning theory is feedback, which will also be discussed in this chapter.

Based on Needs

A theory of motivation based on human needs was described by Abraham Maslow and is known by many as Maslow’s pyramid/hierarchy of human needs [2]. This defined the term “need” in a broad general sense of human biological and psychological requirements. The relation to education was described by Knowles in 1980 [1]: “These basic needs have relevance to education in that they provide the deep motivating springs for learning, and in that they prescribe certain

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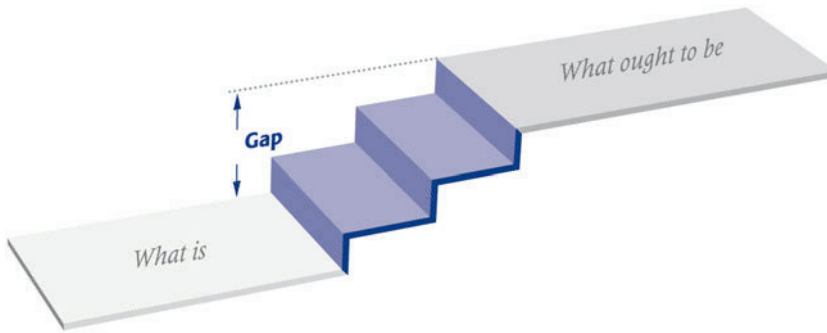


Fig. 1.1 The elements of needs (adapted from Fox and Miner [4])

conditions that the educators must take into account if they are to help people learn.... An educational need, therefore, is the discrepancy between what individuals (or organizations or society) want themselves to be and what they are; the distance between an aspiration and a reality.”

In other words, the educational need can be described as a gap between the present level of an ability (what is) and the desired level of the same ability (what ought to be) required for effective performance as defined by the learners, their organization, or society (Fig. 1.1).

Clarification of who the target learners are, their needs, and their environment is crucial to assure that learning takes place. Kern et al. [3] outlined several methods to assess learners’ needs (Table 1.1).

Motivation

Motivation to learn arises from an educational need. Perception plays a major role in motivation and “...is the cornerstone of understanding why

health professionals may have different levels of motivation related to similar topics and programs...” [4]. It is important to understand that the gap that affects each learner’s motivation is always the gap between the perceived present level of ability of the learner and the desired level of ability and that the extent of discrepancy one perceives between these two affects the extent to which one is motivated to learn. The interactions between perceived and actual needs are summarized in Fig. 1.2.

The best situation is where we find a high perceived need and a high actual need, which results in the learner being highly motivated to learn. On the other hand, very large discrepancies are associated with a high anxiety level, which may lead to feelings of aversion rather than attraction and therefore a lack of motivation to learn. The most difficult situation is when learners believe that their performance is close to the standard but it is not, so the perceived need is low but the actual need is high. In such a situation, the learners will not see any need to learn. The question is now how we can motivate these learners.

Table 1.1 Advantages/disadvantages of several need assessment methods (adapted from Kern et al. [3])

Method	Advantages	Disadvantages
Informal discussion	Convenient, inexpensive, rich in details	Lack of methodology, interviewer bias
Formal interviews	Standardized, quantitative, and qualitative information	Needs trained interviewers, costly
Focus group discussions	Efficient, learn about group behavior, qualitative data	Needs skilled facilitator, time, and financial costs
Questionnaires	Standardized questions, quantitative and/or qualitative data, easy to use (especially online), large samples possible	Question-writing skills needed, response rate issue, time intense for data collection and analysis
Direct observation	Best method for assessing skills and performance	Time-consuming, development of guidelines
Tests	Objective measure of knowledge or skills	Requires time, effort, and skill to construct valid test questions

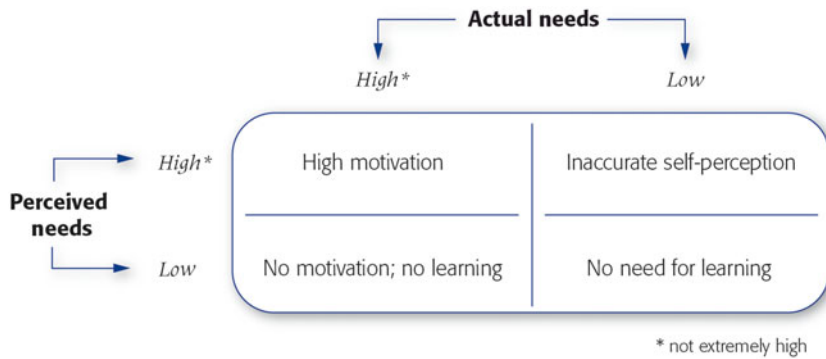


Fig. 1.2 Perceived vs. actual needs (after Fox and Miner [4])

For adults, it is also important to be self-directed and to decide how they want to close an identified gap. Fox and Miner stated that “Motivation to participate in a specific learning activity will be greatest when the physician perceives strong or many goals, that those goals are important, that participating in the specific learning activity is personally satisfying, and that participating will result in achieving goals” [4].

For practical application, it is crucial to consider the following two points to motivate your learners:

1. Help your learners to realize their gaps in knowledge and performance by, for example:
 - Online self-assessments: Based on your defined outcomes, ask your learners about their perceived present level and their desired level. This can easily be done with an online survey tool. It is important that learners can see their results to recognize their gaps.
 - On-site small group discussions: During small group discussions, you can find out about the present level of knowledge, and you can help learners to understand where they are and where they should be. This is important in situations where learners think they already know a lot (although they in fact do not) and would therefore not be highly motivated to learn.
 - Reflection (see also section on “Reflection”): Reflective practice helps learners to identify their gaps.
2. Help your learners to stay motivated by using a variety of teaching methods:
 - Use interactive methods for teaching such as interactive lectures and small group discussions.

- Use new technologies to allow for self-directed learning, e.g., provide online resources such as readings or recorded lectures/webinars.
- Provide learners with clear goals and outcomes.
- Provide time and opportunities for reflection.
- Blend traditional strategies with technology, e.g., self-assessment tests can be completed online and linked to discussion forums.

Outcome Driven

Many teachers declare the objectives before starting a teaching and learning activity. However, these are often the objectives of the teacher: “in the next hour, I am going to tell you ABC, then do DEF...” Such objectives may give learners an idea of what the teaching/learning process will be like. A clear articulation of the learning product, i.e., what the learners are expected to be able to do after the activity, would be more helpful to learners. These expectations, written from the perspective of the learners, are called the intended learning outcomes.

There are several models to help teachers to develop learning outcomes. One is the SOLO (Structure of Observed Learning Outcomes) taxonomy [5], which describes several levels of complexity in the learner’s understanding of a subject: prestructural (learners have unconnected information), unistructural (learners are able to make simple and obvious connections between facts), multistructural (learners see more connections but miss the significance to the whole), relational

(learners appreciate the significance of the parts to the whole), and extended abstract (learners make connections beyond the subject and are able to generalize). Another model is the revised Bloom's taxonomy [6], which identifies six subcategories in the cognitive domain of learning activities: knowledge, comprehension, application, analysis, synthesis, and evaluation. Whether these six subcategories are hierarchical is debatable, but the subcategory "knowledge" here is defined as remembering and recalling (not knowledge in the general sense) and is usually considered the simplest level of intellectual activity. Miller's pyramid can also help teachers to formulate learning outcomes for their learners (Fig. 1.3) [7]. The pyramid shows the ideal stages of the development of clinical competence but can also be applied to learning in other areas. The first stage is that the learner knows what to do; then he/she knows how to do it (i.e., he/she can describe the process but might not be able to do it). The next level is that the learner shows how it can be done in a safe environment, and the highest level is to apply it in actual practice. Similar to Bloom's taxonomy, Miller's pyramid also distinguishes learning that consists of memorizing facts (declarative knowledge) from learning that enables one to apply procedural knowledge in real-life situations.

After teachers have decided on the intended learning outcomes, they plan backward. They need to decide on the teaching/learning activities that will best help learners achieve the outcomes. They also need to decide on the assessment methods and standards with the intended outcomes in mind. Such an alignment of teaching/learning activities and assessment with the outcomes is called constructive alignment [8] and will be discussed in much greater detail in Chapter 4. If the

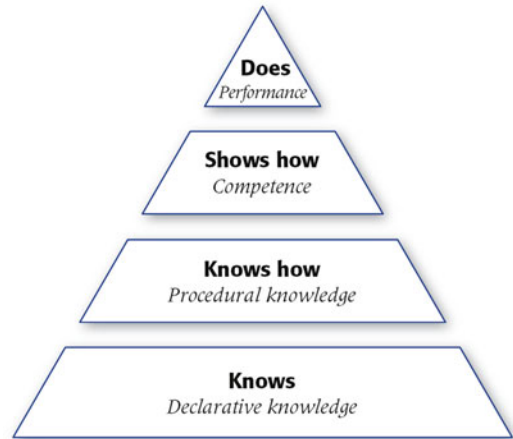


Fig. 1.3 Miller's pyramid. Framework for clinical assessment (after Moore [7])

outcomes are not met by the learners, the teachers may need to reconsider and adapt the teaching/learning activities and the assessment the next time they engage in the same activity, until the intended learning outcomes are achieved to a satisfactory level (Fig. 1.4).

In an outcome-based approach to learning, the intended learning outcomes take a central role. If the outcomes are not properly articulated, it will not be clear what the teaching/learning activities are trying to help the learners to achieve and what the assessment will be measuring. Thus, the articulation of the intended learning outcomes must be carefully done. Each outcome should begin with a verb that describes an observable and assessable action. The action indicates not only whether the learners are able to do certain things but also at what level they are expected to do it after the teaching/learning activity and under what conditions. For example, "describe" and "hypothesize" are appropriate verbs in outcomes since they both indicate not only whether the

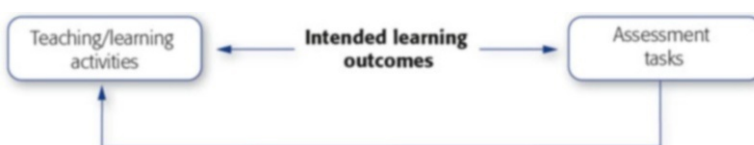


Fig. 1.4 Aligning teaching/learning activities and assessment tasks with the intended learning outcomes

learners are able to understand certain content but also the levels the learners are expected to understand the content (lower level for “describe” than “hypothesize”). Assessment can also be focused on these actions. On the other hand, “understand” will not be an appropriate verb, because it is not observable and can only be indirectly assessed. If it was used in an intended learning outcome, the teacher may have difficulty designing the appropriate teaching/learning activity that will help the learners to achieve it, because it is not clear how much understanding is expected of the learners. The learners will also not know how, and to what level, they will be assessed on that outcome.

An outcome-based approach sets clear goals for learners. If the learners perceive a gap between their current level of ability and the goals, they will be more motivated to take part in the learning activities if they believe the activities have been designed to help them achieve the goals. An outcome-based approach also helps teachers and administrators to cooperate to achieve the same goals, especially if the activity involves more than one teacher. It ensures that the right products are delivered. It is particularly important in the healthcare field because the amount of knowledge learners are required to know is rapidly expanding, while the length of healthcare training programs remains more or less the same [9]. An outcome-based approach ensures that the teaching/learning activities in a program will produce graduates with a set of intended competencies. This approach also encourages debate over the set of intended competencies because the teachers now need to explicitly articulate it [10, 11]. Doing so also enhances the transparency and quality assurance of healthcare training programs.

Active Learning

There is evidence that adults learn better with active learning, which can generally be defined as a learning process in which the learners are engaged in meaningful activities in the classroom and are mindful of what they are doing [12, 13].

The design of a teaching and learning activity determines the tasks that the learners need to engage in and how much active learning is possible. A traditional lecture, which is delivered in a unidirectional manner without interactions between the teacher and the learners, is often used to illustrate what learning is like when active learning is absent. In this kind of learning, the learners passively receive knowledge in a form already determined by the teacher. There are no tasks that the learners need to be involved in. In fact, the learners do not even need to be there for the lecture to take place. In active learning, the learners do not just sit and passively receive information. They are engaged in such activities as discussion in small groups, think–pair–share activities, short writing exercises, debate, or gaming. Some of these activities can be integrated into lectures, thereby introducing some element of active learning into this relatively passive form of teaching and learning. But the lecture format makes these active learning opportunities difficult. Other activities that have been specifically designed to stimulate active learning include collaborative learning [14], cooperative learning [15], and problem-based learning [16], and active learning can be integrated into most other activities, including anatomical dissection (see Chapter 23).

Tasks that stimulate active learning are those that encourage learners to take ownership of the learning, which stimulates them to think critically and creatively in order to accomplish certain tasks. By engaging in these tasks, learners reflect on their prior or newly acquired knowledge, identify gaps in their knowledge, seek out relevant information, assess current problems, analyze facts and opinions, etc.

Although the main responsibility of learning rests with the learners in active learning, the teacher also has a very important role to play. The teacher should cease to be the “sage on the stage” as in a lecture and should become a “guide on the side” by providing a safe and inquisitive environment for the learners to explore and construct knowledge. A friendly and supportive environment encourages the learners to articulate their

thoughts and to ask and answer questions in front of others without the fear of feeling embarrassed when they make any mistakes.

Reflection

People learn from experience by reflecting on it. Reflection is thus an integral part of learning. Before a meaningful discussion can proceed, “reflection” must first be defined because this term is used in everyday life and has different meanings in specific circumstances. Moon [17] defined it as “a form of mental processing with a purpose and/or anticipated outcome that is applied to relatively complex or unstructured ideas for which there is no obvious solution,” while Boud et al. [18] defined it as “a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to a new understanding and appreciation.” A more inclusive definition is given by Sanders [19]: “Reflection is a metacognitive process that occurs before, during and after situations with the purpose of developing greater understanding of both the self and the situation so that future encounters with the situation are informed from previous encounters.” It is thus considered a process of thinking about thinking (metacognition) that involves not only the acquisition of new knowledge or skills but also an understanding of both the self and the situation, so that the learner will respond differently in future encounters.

The significance of reflection can be described using Kolb’s cycle or the learning cycle [20]. The cycle consists of four stages (Fig. 1.5). Experience is just one of the four stages, and it alone is not sufficient for learning to occur. One needs to reflectively observe the experience (“reflective observation”) and then formulate and integrate the new “skills, knowledge, attitudes and values with the learners’ cognitive framework” [21] (“abstract conceptualization”). Based on the new cognitive framework after reflection on a previous experience, the learner will respond differently when he or she encounters similar situations in the future (“action”). The new response is itself an experience that the learner can reflect on, leading to further modification of the cognitive framework.

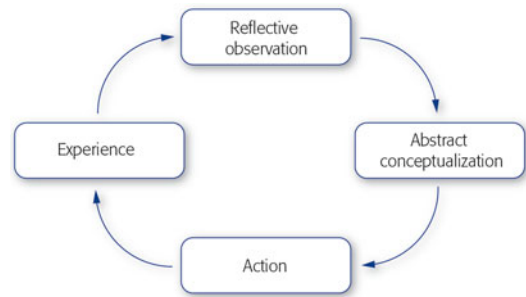


Fig. 1.5 Kolb’s cycle (after Kolb [20])

Learners going through the stages in Kolb’s cycle are more likely to achieve deep learning because numerous links are formed between the new facts and ideas and their existing cognitive framework, in contrast to surface learning, in which new facts and ideas are isolated and unconnected [22]. The linking process also gives more meaning to the new knowledge, skills, attitudes, and values by relating them to the larger context.

Given the important role of reflection in learning, it is surprising that it does not spontaneously occur as often as desired and needs to be actively promoted. Moon [23] pointed out that learner reflection can be promoted when the tasks are challenging and ill structured (e.g., real-life examples), demand ordering of thoughts (e.g., following exposure to disorganized data), involve evaluation, and require integration of the new into previous learning. Chapter 23 illustrates how teaching and learning around anatomical dissection can be structured to promote reflection.

Feedback

Feedback is an essential part of medical education. It is “...specific information about the comparison between a trainee’s observed performance and a standard, given with the intent to improve the trainee’s performance” [24, 25]. It helps learners to maximize their potential at different stages of their lifelong learning path, raise their awareness of strengths and areas for improvement, and identify actions to be taken to improve performance. Therefore, the purpose of feedback is to improve performance [26] and reflection [25], not to criticize or judge.

A common model for giving feedback in clinical education settings was developed by Pendleton [27]. Pendleton's rules consist of the following steps:

1. Check if the learner wants and is ready for feedback.
2. Allow the learner to give comments/background to the material that is being assessed.
3. The learner states what was done well.
4. The observer states what was done well.
5. The observer states what could be improved.
6. The teacher states how it could be improved.
7. An action plan for improvement is made together.

Pendleton's rules are structured in such a way that the positives are highlighted first (steps 3 and 4) in order to create a safe environment. In addition, step 3 forces the learner to reflect on his/her action. This is followed by the observer reinforcing these positives and adding some more if needed. "What could be done differently?" is then suggested, first by the learner and then by the observer. Again, it gives the learner the opportunity to reflect and to decide what to do next time. The advantage of this method is that the learner's strengths are discussed first. Avoiding a discussion of weaknesses right at the beginning prevents defensiveness and allows reflective behavior in the learner. The most crucial step is step 7, the action and follow-up plan, where the learner agrees with the observer on changes he/she will make for the next time.

Although this model provides a useful framework, there have been some criticisms of its rigid and formulaic nature, and a number of other models have been developed for giving feedback in a structured and positive way. One of these is the "sandwich" model, which starts with identifying the learner's strength, is followed by identifying the learner's areas in need of development, and concludes by reinforcing the strengths again.

Elements of Effective Feedback

- Provide a culture of giving feedback between learners and teachers. Feedback should be given **frequently**.
- Give feedback only when asked to do so or when your offer is accepted.
- Schedule formal feedback sessions that are convenient for the learner and the teacher, and adequate time should be given for both parties to prepare. Give feedback in a **timely** manner (not too soon or too late after the event).
- Select a location that is as private as possible.
- Measure the learner's performance against **standards** and well-defined goals and objectives.
- Provide **specific** and **accurate** information, including examples, not generalizations.
- Focus on the **positive**.
- Focus on **behaviors** that can be changed, not personality traits.
- Be **sensitive** to the impact of your message. Feedback is for the recipient, not the giver.
- Consider the content of the message, the process of giving feedback, and the congruence between your **verbal and non-verbal messages**.
- Encourage **reflection**.
- Be clear (have a goal) about what you are giving feedback on, and link this to the learner's **overall development** or intended program outcomes.
- Do **not overload**—identify two or three key messages to outline at the end. Be sure that the learners themselves identify the changes they want to make.

Summary

To promote effective learning, teachers need to understand the needs of learners and to motivate them by enabling them to perceive any gaps that exist between their present level of ability (what is) and the desired level (what ought to be). Learners can be motivated to learn better if they are informed regarding the specific learning outcomes of the activities and how achieving these outcomes will help them to bridge their gaps. Teaching and learning activities and assessment methods and standards should all be designed to help learners achieve these outcomes. Learners should be actively engaged in the learning process, instead of passively receiving information. They should be given frequent, accurate, and specific feedback at the appropriate time and be given time and opportunities for reflection.

References

- Knowles M. The modern practice of adult education: From pedagogy to andragogy. 2nd ed. Chicago, IL: Association Press/Follett; 1980.
- Maslow AH. Motivation and personality. 2nd ed. New York: Harper and Brothers; 1970.
- Kern DE, Thomas PA, Hughes MT. Curriculum development for medical education: A six-step approach. 2nd ed. Baltimore: The Johns Hopkins University Press; 2009.
- Fox RD, Miner C. Motivation and the facilitation of changing, learning, and participation in educational programs for health professionals. *J Contin Educ Heal Prof.* 1999;19:132–41.
- Biggs J, Tang C. Teaching for quality learning at university. 3rd ed. McGraw-Hill: Berkshire; 2007.
- Anderson LW, Krathwohl DR, Airasian PW, et al. A taxonomy for learning, teaching and assessing: A revision of bloom's taxonomy of education objectives. 2nd ed. New York, NY: Longman; 2001. p. 336.
- Moore DE Jr, Green JS, Gallis HA. Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities. *J Contin Educ Heal Prof.* 2009;29:1–15.
- Biggs JB. Enhancing teaching through constructive alignment. *High Educ.* 1996;32:1–18.
- Harden RM, Laidlaw JM. Essential skills for a medical teacher. Edinburgh: Elsevier Churchill Livingstone; 2012.
- Swing SR. The ACGME outcome project: Retrospective and prospective. *Med Teach.* 2007;29:648–54.
- Simpson JG, Furnace J, Crosby J, et al. The Scottish doctor—learning outcomes for the medical undergraduate in Scotland: A foundation for competent and reflective practitioners. *Med Teach.* 2002;24:136–43.
- Bonwell CC, Eison JA. Active learning: Creating excitement in the classroom. ASHE-ERIC higher education reports (ERIC document reproduction service no. ED 336 049). 1991.
- Prince M. Does active learning work? A review of the research. *J Eng Educ.* 2004;93:223–31.
- Barron B. Achieving coordination in collaborative problem-solving groups. *J Learn Sci.* 2000;9:403–36.
- Millis B, Cottell Jr P. Cooperative learning for higher education faculty. American council on education. Phoenix: ORYX Press; 1998.
- Hmelo-Silver CE. Problem-based learning: What and how do students learn? *Educ Psychol Rev.* 2004;16:235–66.
- Moon JA. A handbook of reflective and experiential learning: Theory and practice. Abingdon: Routledge Falmer; 2004.
- Boud D, Keogh R, Walker D. Reflection: Turning experience into learning. London: Kogan Page; 1985.
- Sanders J. The use of reflection in medical education: AMEE guide no. 44. *Med Teach.* 2009;31:685–95.
- Kolb DA. Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice Hall; 1984.
- Branch WT, Paranjape A. Feedback and reflection: Teaching methods for clinical settings. *Acad Med.* 2002;77:1185–8.
- Houghton W. Engineering Subject Centre Guide: Learning and teaching theory for engineering academics. Loguhborough University, Engineering Subject Centre. 2004.
- Moon J. Reflection in learning and professional development. London: Kogan Page; 1999.
- van de Ridder JM, Stokking KM, McGaghie WC, ten Cate OT. What is feedback in clinical education? *Med Educ.* 2008;42:189–97.
- Gordon J. BMJ ABC, of learning and teaching in medicine: One to one teaching and feedback. *Br Med J.* 2003;326:543–5.
- Oxman AD, Thomson MA, Davis DA, Haynes RB. No magic bullets: A systematic review of 102 trials of interventions to improve professional practice. *Can Med Assoc J.* 1995;153:1423–31.
- Pendleton D, Scofield T, Tate P, Havelock P. The consultation: An approach to learning and teaching. Oxford: Oxford University Press; 1984.