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Theories and Practical Steps for Delivering Effective Lectures

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Abstract

Several approaches to teaching, such as problem-based learning, team-based learning and case method teachings are increasingly being adopted. However, the lecture format is still the most widely used approach to teaching, especially for a large class size. Nevertheless, traditional lectures or didactic lectures are considered ineffective in affecting learning outcomes of knowledge retention, student satisfaction, synthesis and elaboration of knowledge. Consequently, new strategies to transform didactic lectures into effective lectures, and to facilitate deeper learning are emerging due to recent advances in our understanding of the cognitive sciences on learning and memory. These advances can be applied to teaching to diverse learners and across different settings in the health professions education. They can also be used as a guide to faculty development, organization of lectures and curriculum development. In this article, we reviewed selected principles of learning and memory to determine those that are most critical to improving didactic lectures, guiding instructors to effective teaching, and deeper student learning. Our analyses of these principles have produced key practical steps that are essential to enhancing lectures, making them interactive and effective. Further, these steps can be adopted across different learning environments of health education.

Keywords: Didactic lecture; Effective lecture; Cognitive sciences; Learning; Memory

Introduction

Traditional lectures, also known as didactic lectures, are still the primary methods of instruction in medical and higher education, particularly for large class sizes [1-3]. However, several studies on comparing the effectiveness of didactic lectures with those of interactive, or effective teaching styles (e.g. case reports, technology-assisted, problem-based, and open discussion) showed that student satisfaction, learning outcomes, deeper approach to learning, and knowledge retention is better following interactive lectures [4-8]. Therefore, because of these criticisms of didactic lectures, increasing efforts are being made to transform didactic lectures into effective lectures. Capturing and maintaining the attention of students, active participation of students, instructor-student questioning, discussion, and formative quizzes with immediate feedback characterize effective lectures [9-11]. Sometimes, the lack of faculty training in presenting an interactive lecture, rather than the method of delivery itself, is one of many reasons for ineffective lecturing [12-14].

The purpose of this article is to propose practical approaches for delivering effective lectures, especially for the less experienced, new faculty, or instructor. This approach adds to the list of effective teaching strategies. This article also explores and exposes faculty to new ideas about presenting lectures, organizing lecture materials, and enhancing students' retention of new materials. Some of the challenges for instructors in delivering their lectures are (1) how to deliver an effective lecture in an organized manner with an efficient use of time, but at the same time enhance students' learning experience and retention of knowledge, and (2) trying to cover so much content materials in a limited time. This article provides guidance to deal with both of these challenges.

We propose practical steps for delivering effective lectures, which are based on recent advances in the cognitive sciences on learning and memory [15,16]. These steps are adaptable for any length of lectures, easy to follow, and can be used as a resource guide for faculty development (Table 1).

Step One: Opening

An effective lecture efficiently transfers knowledge to students by

enhancing their conceptual understanding and retention of knowledge [17-19]. To achieve these goals, students should be motivated to be interested in and focus their attention to a lecture. Therefore, an opening summary remains an important prerequisite of an effective lecture. The first step in delivering an effective lecture could start with "captivating" statements, which will excite students about the lecture [20]. The statements should clearly outline the purpose of the lecture. Students could also be encouraged to be active participants during the lectures because classroom attendance and participation leads to success in examinations [8]. Several strategies have been suggested to optimize students' interest and attention during lectures [21-25] including:

1. Stating the purpose of the lecture to prompt the learners to be engaged and to seek their immediate attention.
2. Reviewing the lecture objectives that challenge the learners to a set of expectations. This also builds up curiosity and clearly outlines their role in meeting those expectations.
3. Posing a question at the beginning of the lecture for the students to think about. This creates a challenge for the learners and alerts them to focus during the lecture, with the anticipation of seeking answers to that question.
4. Creating a positive and safe learning environment by acknowledging students' responses.

An excellent opening summary is critical to the success of a lecture. It encourages the students to focus with anticipation and mental alertness. The opening summary should be brief and captivating

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Steps and Principles	Description	Suggestions and examples
Step 1, Opening	State the purpose of the lecture.	Emphasize why the lecture is important. E.g. If the lecture is on "Glucose Metabolism", the students should be aware of the pathological consequences and morbidity, such as nephropathy, neuropathy, and amputations that are associated with disorders in the pathways of glucose metabolism. Show images of diabetic foot ulcers, and diabetic patients with amputations.
	Use generalized statements to capture the focused attention of the students. Multi-media resources	Specify what is expected of the students to learn. E.g. Identify the specific biochemical pathways of glucose metabolism that they should study. Ask the students to think of other examples of pathologies associated with disorders in glucose metabolism. E.g. <ul style="list-style-type: none"> • Hypoglycaemia can lead to unconsciousness, coma and eventually death. • Hepatomegaly (liver enlargement), and muscle wasting
Step 2, Presentation	Elaboration	Organize the main body of the lecture into subheadings that are associated with the concepts to be explored. The subheadings should reflect the objectives of the lecture. E.g. the following objectives could serve as subheadings for the presentation and lecture notes on "Glucose Metabolism" <ul style="list-style-type: none"> • Define glucose homeostasis • Describe the different phases of glucose homeostasis • Outline the prevention of hypoglycaemia and its clinical effects • List the clinical consequences of glycogen breakdown in terms of glycogen storage diseases • Describe the effect of insulin on glucose metabolism • List the harmful effects of hyperglycaemia
	Multi-media resources	Video graphics could be used to illustrate biochemical pathways, physiological functions, and their disorders.
Step 3, Learner-Instructor two-way Interaction	Encouraging active learning	In order to encourage students to participate effectively in their learning in an efficient manner, the instructor's questions should be embedded in the students' notes, or available on an on-line site for the students, well in advance of the lecture. Likewise, the instructor should solicit questions from students, in advance of the lectures, that are to be addressed in class.
	Multi-media streaming	Video illustrations of biochemical pathways or functions of different organ systems could also act as the interactive piece
Step 4, Formative Assessment	Assessment drives better learning and performance	The students should be given, at the most, 5 multiple-choice questions to attempt in class. Then, the instructor should provide immediate feedback on those questions
	Multi-media devices	The use of <i>i-clickers</i> by the students to answer the multiple-choice questions and analysis of their results in real time will provide the basis for the feedback.
Step 5, Conclusions	Consolidating the concepts	The instructor draws attention to the most important concepts of the lecture. E.g. by providing a summary of the main ideas

Table 1: Examples of Specific Principles and Suggestions.

because students' first impression of the lecture is important, and their awareness and receptiveness level are their highest level during the first 5 minutes [26].

Step Two: Presentation

The second step in delivering an effective lecture is presentation of the content, or body of the lecture. The core content is easily mastered if it is organized and analyzed into constituent components, key concepts identified and their interrelationships explored. The sequence of the concepts and their connections lays the foundation for the students to extend their knowledge in new and original ways [22,27]. There are some challenges relating to content coverage. One of these challenges is the conflict between content and learning:

Content versus learning

The conflict between content and learning could be due to the finite demand of time to satisfy coverage of curriculum materials, while at the same time facilitating active learning [28]. Face-to-face lectures, however effective they are, cannot completely resolve this conflict. To deal with this conflict, several strategies have been applied to the lecture format. Some of these strategies are based on the principles of "blended learning" that have significantly enhanced teaching effectiveness; these principles involve embedding information technological advances with pedagogy [28-30] including:

1. Online course materials to cover some of the basic concepts prior to the lectures.

2. Online student-centered activities with specific learning objectives.
3. Using the Internet to identify multimedia items, such as animations, videos, and slideshows.
4. Collaborative Web-based case studies that can allow students to interact online.
5. Interface technology for instant feedback without the anxiety of grading students' responses.

Apart from resolving the anxiety over content coverage within a time constraint, effective lectures could also encourage active learning. Some of the approaches that have been described to present the course content to enhance effective students' understanding of new knowledge include: elaboration, learning activity, and learner's questioning for clarification.

Elaboration

This involves organizing the content according to the objectives, interpreting and analyzing concepts, making connections between concepts, relating to prior knowledge, and creating situations for students to think about extending their knowledge to new and hypothetical situations [31]. This can also be accomplished by the use of analogies, concrete examples, video images, and role-playing, which connects to the learners' background and providing a relevant context to the lecture material.

Learning activity

Several studies have established that the human brain's capacity for focused attention to a lecture is between 10 and 30 minutes, with maximum concentration of not more than 20 minutes [18,32]. After this time, students cannot concentrate and engage in deep learning. In order to compensate for inattention and to offset ineffective learning, different types of stimulation could be used during lectures. Changing the lecture format with other styles of learning can do this. Such strategies could be a simple rest, alternating presenting medium, and assigning students a short-learning task [18,33,34]. Recognizing the attention span of students is important. After presenting the content, allow the students to rest by doing something with the course material, make them engage in their own learning and being accountable. This can be achieved, for example, by allowing them time to write a summary of the key points in the lecture.

Learner-questioning for clarification

In order to ensure that complex information is made clear and reasonably understood by the students, give them the opportunity to ask questions on concepts or key facts. The learners can send questions to the instructor ahead of the lectures. The instructor should, then, address these questions during the lectures by providing concise answers or explanatory responses. This practice also allows the students to have a break from focused attention during the lectures. These interruptions temporarily restore stimulation levels [25]. Thus, for continuation of the lecture, use constructive and learning-related activities to break up your teaching. Typically, this will involve learner-instructor interaction, structured discussion, and technological interaction [35,36].

Step Three: Instructor-Learner Interaction

The instructor-learner interaction builds in the component of a two-way communication in an effective lecture, which is meant to engage students in active learning. However, for instructor-learner interaction to be engaging, meaningful, and effective, it should take into consideration characteristics of instructors and learners.

Characteristics of learners: the generational mix

Educators should learn new ways of how to approach the adult learner generational mix that is now in our classrooms [37]. These teaching approaches should exploit the diverse differences in generational characteristics of the learners. Only, then, can their expectations be met, and effective lecturing and learning can occur [38]. The generational mix is composed of the millennial generation, those born in 1981-2002, and their predecessors: the previous Generation X, those born between 1960-1980, and the Baby Boomers, those born between 1943-1960 [37]. Some of the characteristics of these generations that deserve consideration and have implications for teaching practices and enhanced learning [37-39] are summarized:

Millennial generation

This generation, also known as the Net-Generation, which is well accustomed to advances in online, Internet and Web-based technologies prefers instant communication and knowledge, and can multitask in a virtual environment. However, this generation is not as independent as the preceding generations [39]. To facilitate learning for this group, moving courses online alone is not enough. The course should be interactive with use of discussion multimedia platforms and working collaboratively. Thus, this generation orients to learning that involves hands-on experience. This group also requires more structure

in their learning, and demands instant and regular feedback, with a view to entitlements. The interests of this generation in understanding the lectures and to apply it to real life situations, just as Generation-X and the Baby Boomers, is an important contribution to their motivation to learn.

Generation-X

This generation that was exposed to the growth in technological advances in communications, drug abuse, higher family problems, with more working families, and political scandals, has a more pessimistic view of society. Nevertheless, they have a greater sense of independence and critically judge any situation, and adjust their working lives to satisfy family commitments. This generation is adept at making personal connections to their learning environment, including their classmates, teachers, and new materials [38]. Their self-efficacy and focus on personal development makes them likely to find teaching approaches that focus on connecting to personal experiences useful and effective.

Baby boomers

The Baby Boomers grew up in traditional homes and just saw the beginning of technological development. They were oriented to the learning process that embraces, and not surprisingly were accustomed to didactic lectures. In addition, the Baby Boomers are motivated to learn when the material affects their personal growth and gratification. They find it difficult to adjust to instant learning activities because of their focus on work-life balance and unfamiliarity with new content materials. Thus, their orientation to learning is best suited to explore and discover on their own [38].

Characteristics of instructors

Effective instructor-learner interaction should also take into consideration the instructors' non-teaching related attributes, such as verbal and non-verbal skills. Several studies have demonstrated that verbal and non-verbal skills affect students' rating of teaching effectiveness and learning outcomes. Affective non-verbal and verbal skills are considered behaviors that remove barriers to learning by stimulating connection between learner and instructor. Some of these skills improve cognitive and affective learning outcomes, and are positively correlated with teaching effectiveness. These skills include humor, direct eye contact with the learners, vocal inflections, and direct body posturing, gesturing, speaking loudly, using voice for emphasis and exaggeration, and projecting a feeling of enthusiasm and excitement [40-42].

Simply asking questions or providing learners with an activity during a lecture may not generate instructor-learner interaction, gain the learner's attention, or create a stimulating learning environment. Several factors require consideration to effectively incorporate questions and other activities into a lecture to promote active learning. What should be considered are: when instructor-learner interaction should commence; what types of questions and activities should be used; whether learners should know the questions or activities prior to the lecture, and how much time should be allotted for instructor-learner interaction?

When to commence instructor-learner interaction

Research has indicated a drop in vigilance and learner concentration between 10 and 30 minutes [18], or at 30 minutes, the halfway point, of a one-hour lecture [32]. Therefore, instructor-learner interaction could occur at approximately 30 minutes into the lecture to provide an opportunity to change the lecture format and regain learner attention.

Type of interaction

Both instructors and learners identify high levels of participation and interaction in a lecture as an important component of teaching excellence [43]. In a large class, interaction can be incorporated into lectures as questions, which can be asked in different ways, such as open-ended questions or close-ended questions and can vary in degree of difficulty. Regardless of the specific design of the questions or activities, the intent of the instructor-learner interaction is to stimulate discussion and provide students with feedback. Asking a question and providing an answer at a later time may not be enough to accomplish active learning; better cognitive learning outcomes occur when students receive immediate feedback to their responses [44]. There are many ways to be creative in instructor-learner interaction with the use of a variety of questions and activities. For example, questions can be embedded into lecture notes for students to come prepared to discuss in class.

One study found that allowing students to write down their responses on index cards, discuss responses in small groups while the instructor circulated, and then discuss responses with the larger class was an effective way to encourage attendance and facilitate learning [45]. Another study used content-based questions using a fill in the blank question format and found that student exam scores increased with using content-based questions in lectures compared to lectures without such questions [46]. In addition, the authors of that study indicated that using content-based question techniques allows instructors the opportunity to address content that learners do not understand based on responses to the questions.

To achieve instructor-learner interaction it is the instructor's responsibility to create a safe environment for asking and answering questions. Regardless of the type of question or the level of difficulty for the question, the instructor should provide consistent and genuine positive reinforcement to all students. This will aid in generating instructor-learner interaction and foster student confidence to become active learners.

Instructor-learner interaction occurs in the classroom

Since most instructor-learner interaction occurs in the classroom, attending lectures is necessary. Having lecture notes in advance may deter lecture attendance for some learners; the same may be true for providing the questions or activities to the student in lecture notes before the class. On the other hand, attendance may be encouraged if students are provided lecture notes without questions and activities and are made aware that these additional learning opportunities will be offered during the lecture. Again, this depends on the learner.

Allotted time for instructor-learner interaction

It is recommended that in a one-hour lecture, instructor-learner interaction should be limited to about 12 minutes. This short time frame ensures that the learner will remain vigilant during the interaction. This is in keeping with the time frames where attention becomes fleeting [32-34].

Step Four: Formative Quiz

Step 4 in the delivery of an effective lecture is giving a formative quiz at the end of the lecture. Regular formative assessments, in the form of quizzes, with immediate feedback are a vital part of effective lectures, helping to promote better learning. This can be achieved by encouraging a two-way communication. The importance of active engagement of students during the lecture is widely accepted [47,48].

Instructors can enhance active learning by using several interacting methods, including quizzes, case reports, problem solving exercises and students working cooperatively. Wisely choosing the type of activity influences the retention of material. More importantly, it should be designed around the learning objectives as this helps to promote thoughtful engagement on the part of the students.

Quizzes can be given in a lecture prior to the closing remarks. They could consist of multiple-choice questions, or short written answers. Quizzes with higher cognitive questions (requiring that student mentally manipulate bits of information previously learned to create an answer) result in gain in student's achievement [48]. Additionally, computer based formative assessments in conjunction with class quiz can enhance learning [49]. These computer based formative assessments could be accessed by students anytime after lectures; this could diminish some of the anxiety associated with time limitations for in-class formative tests, leaving more time to cover the content.

Although effectiveness of multiple-choice questions as a mean of formative assessment is difficult to establish empirically, the feedback from students and instructors suggests that they learn better during the process of taking the test [50]. Also, quizzes at the end of lectures raise long term retention of course material. Irrespective of the method used for formative assessment, one of the most important aspects is providing immediate feedback to students' responses. This helps to build up a stimulating atmosphere and encourages more students to engage in discussions, positively affecting their achievements.

Step Five: Conclusions

Step 5 in the delivery of an effective lecture is to provide a summary of important concepts in key points or bulleted format at the end of a lecture. It is as important as the opening summary used to introduce that lecture. Thus, always ensure that there is enough time at the end to summarize the lecture. It helps to draw attention towards the most important concepts, facts, or ideas. By focusing the student's attention in the last minutes of class, an instructor establishes the most important facts and tries to make a link between what was taught and what they will be able to use in practice. The use of the "take home messages" can provide additional reinforcement. Conclusion also allows time for elaboration and clarification of the concepts presented. Objectives stated in the beginning should be reiterated, assuming that they have been accomplished. "A good conclusion ties introduction and content together in a manner similar to that of an abstract that precedes a well-written manuscript" [51]. The conclusion also highlights the important information presented and ensures that students leave the classroom with a clear understanding of the lecture materials.

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