

Creating Dynamic Learning Experiences Using Student Response Clickers

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The Structure of This Handbook

This handbook provides step-by-step instructions for how to use clickers in your class. For each task, a quick-glance list of instructions is provided, then the very same list is repeated with screen captures. As you become more proficient you will likely prefer the shorter list to the more elaborate screen capture list.

Examples. For most of the handbook tasks, we provide examples for how the clickers can be used in the classroom. These examples can be quickly found because they are presented in gray text boxes with a small clicker icon in the bottom corner.

Examples are presented in gray call-out boxes with the clicker icon in the lower right corner.

An Example: Using Clickers for a Lab Exam

Dr. Goodmurphy uses clickers in lab exams. Students walk around to different stations—each station corresponds to a question—and at the station the student reads a multiple choice question and uses the clicker to respond. Creating the exam beforehand takes a little more time than it would have without clickers.

When the student has completed all the questions, the answers are submitted from the clicker. The student receives the exam grade instantly.

What's the value of this approach? There are two chief benefits to this approach: first, for the instructor, grading is automatic. Most of the instructor's labor is prior to the exam. Second, students receive their grades instantly. The grades are in a digital format and may be uploaded to Blackboard or forwarded within our EVMS formal exam system easily.



Check out these examples...

Seven examples of how clickers are being used right now at EVMS:

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The Step-by-Step Instructions... In most cases, we provide the step-by-step instructions with screenshots entered where we think they will help you understand the process. From time to time, we provide a quick list of text instructions without any screenshots, and follow that immediately with instructions that contain screenshots for every step. In these cases, you will see the title, “**Step-by-Step Instructions with Screen Captures**” immediately following the text instructions. We do this when a task is important or complex.

Introduction and Getting Started

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Introduction: Creating Engaging Learning Experiences Using Student Response Clickers

Learn: *verb* \ 'lərn \

1. To gain knowledge or skill by studying, practicing, being taught, or experiencing something
2. To cause (something) to be in your memory by studying it
3. To hear or be told (something)
4. To find out (something)

Merriam-Webster.com (2013)

Learning is something learners do... it is an action, it is a verb.

We often think of a learner as a kind of passive recording device, receiving and then storing presented information. It is easy to think of the best learners as simply having a 'high resolution' recording capacity. But, the overwhelming body of learning research presents a different picture. Grabowski (2003) summarized the research well: "The learner is not a passive recipient of information, rather he or she is an active participant in the learning process, working to construct meaningful understanding of information found in the environment (p. 720)." You could say that if the learner does not actively participate in the learning process, learning will not occur.

This is important stuff. How you look at learning dictates how you will design your learning experiences. At EVMS, you may have over 200 students in a single lecture. If you look at those students as recording devices (of varying efficiency), you will approach the learning from one direction, but if you look at the students as having to build knowledge into frameworks to use it, you will approach it from another.

Wittrock (1974) described effective learning this way: "Although a student may not understand sentences spoken to him by his teacher, it is highly likely that a student understands sentences that he generates himself (p.182)." Wittrock's generative learning theory has become foundational in the field of learning design. Rather than having us see learners as a kind of computer-memory device, Wittrock (1990, 1991, 1992) emphasized the importance of learners generating relationships between the external environment and their own existing knowledge. He posited two key types of learner generated relationships: first among the different parts of external stimuli (perceived information) and, second, between that information and the learner's existing prior knowledge.

"Although a student may not understand sentences spoken to him by his teacher, it is highly likely that a student understands sentences that he generates himself (p.182)."
Wittrock (1974)

The trick for instructors is to create situations in which learners are led, encouraged, coerced (☹), tricked (☹), or lured into constructing their own cognitive and behavioral relationships between principles, processes, and facts.¹

“Wins” in the EVMS World of Learning

Therefore, when we get students actively participating in the problem solving and difficult work of learning, it is a win. Table 1 (Appendix A) provides examples of research in effective generative learning strategies. This table is not an exhaustive summary, it is a small sample of strategies that get learners actively engaged in the process of learning. All of these strategies involve getting the learner to personally *do something* with the information they are processing.

But, what if there are over 200 students in the classroom?

Our goal at is to create learning experiences that engage learners so that they invest themselves in study, summary, paraphrasing, outlining, note taking, practice, listening, discussion, debate, argument, theorizing, discovery, and fruitful experience. At the end of the day, learning is something the learner must do. Getting all of our students to engage and actively grapple with the topic at hand is difficult, especially in those situations where there may be over 200 students in a class.

Our response clickers are an excellent way to get students actively engaged in the content we are teaching. Using the clickers we can get them each involved with the lecture content, with each other, and we can provide effective and pointed feedback quickly. In addition, our response clickers give us the ability to track student responses during practical experiences, and provide performance feedback instantly. Of course they are not a panacea – they are not the solution to every learning problem. But, used intentionally, they are an excellent tool.

This how-to handbook provides you with practical step-by-step procedures to effectively use our response clickers to make your classes more interactive, more engaging, and more effective. In addition, we will outline a paradigm for practical assessment using the clickers. Finally, we provide directions for saving and using the student response data in either *Blackboard* or for formal exams.

Of course the clickers are not a panacea...

But, used thoughtfully, our response clickers are an excellent way to actively engage a large group of students.

¹ NOTE: Please don't confuse this perspective with *Constructivism*, though you may notice the use of similar words. Wittrock's generative learning theory is based in an enormous body of empirical research in cognitive learning. Constructivism, consistent with its philosophical under-pinnings, is not.

How the Response Clickers Work

Overview: Our current student response clickers are made by *Turning Technologies*. The system operates off of a configurable radio frequency.

The Three-Part Response Clicker System

The *Turning Point* Software

You manage the process through the software. Here you create questions and manage student information. It is available as a free download (see “Getting Started” below).



The Response Clicker

Students buy the response clicker in the EVMS Bookstore. They then register their clicker in *Blackboard*. The student only needs to enter the clicker number in *Blackboard* one time during their EVMS academic career.



The USB Receiver

The USB receiver is a device that plugs directly into the USB port of your computer. If you have already loaded the *Turning Point* software, the software will automatically detect and energize the receiver.



Under most circumstances, you will use the software in conjunction with *PowerPoint* to create questions and capture responses to questions during a lecture. In this case, you would open the *Turning Point* software, and from within *Turning Point* open a *PowerPoint* presentation, add a question, and then present the question to students in the natural course of the lecture. When the *PowerPoint* slide with the question on it appears, you will notice a window at the top of the screen that looks like this:



This means that the system is ready to receive answers to the questions that students would submit using their clickers. The students have done this enough that they know when they see a question slide to respond to the question.

This diagram presents the same process from another perspective:

An Overview of How the Clicker System Works

1. Polling opens and “receiver” sends signal to response clickers.

2. Student selects answer and responds using clicker. Answer is transmitted back to “receiver.”

3. Responses are collected and presented.



Technical Requirements

Turning Point is designed to function on most computers; however, there are some basic hardware and software requirements.

Requirements for Software and Hardware

The following software and hardware specifications are required before using *Turning Point*:

- Microsoft Windows: XP, Vista, 7 or 8.0 (32 or 64 bit)
- Microsoft Office: 2003, 2007, 2010 or 2013 (for *PowerPoint* Polling and viewing exported reports in Excel)
- Microsoft .NET 3.5 SP1
- Intel or AMD 2GHz processor
- 512 MB RAM
- 120 MB hard disk space
- 1024 x 768 at 32-bit color or higher resolution, 100%DPI
- Standard USB 2.0 port (for USB-based hardware devices)
- Ethernet or 802.11 compatible wireless network card required if ResponseWare is in use
- Adobe Flash Player (for Animated 2D/3D charts)
- Adobe Acrobat Reader (for printing)
- Java 7 or later (for importing RTF, DOC, DOCX and QTI documents and exporting reports to Excel and CSV)

Getting Started

To get started with , the software must be downloaded from www.turningtechnologies.com/downloads. Uninstalling previous versions of Turning Technologies software is not necessary; however, only one version of the software should be open at any given time.

Please feel free to call Julie Bridges or Don Robison whenever you need help with clicker-related issues!

Software Download and Setup

Turning Point can be downloaded through the *Turning Technologies* website. After it has been downloaded, the file will need to be unzipped or installed depending on the version that was downloaded.

Downloading Turning Point Software

The *Turning Point* software is accessible through the Turning Technologies website.

Prerequisites

Please verify that your computer meets the *Technical Requirements* before downloading *Turning Point*. These requirements are listed in Appendix 3 of this handbook.

How to download *Turning Point* software...

1. Go to www.turningtechnologies.com/downloads.
2. Click *Turning Point* and then click the **link** to download the PC version.
3. Enter the required information and click **Submit**.
4. Click the **link** to start the download.
5. **Save** the file to a specified location.

Opening Turning Point (from the zipped file)

The zipped file must be extracted before *Turning Point* can be opened.

How to open *Turning Point* (zipped file)...

1. Double-click the downloaded zip file.
2. Select the desired folder location and click **Unzip**.
3. Open the unzipped folder and double-click **TurningPoint.exe**.

Follow the instructions to install *Turning Point*.

How to Configure for EVMS Classrooms

- Under PREFERENCES in the Turning Point software, select CONNECTIONS and then select **Channel 41**. We generally keep the students on this channel to reduce confusion.

Under good conditions, the connection should be reliable between the clicker and receiver up to 200 ft. We do not have many problems in our normal classrooms with connectivity (excepting those instances when student clicker batteries are low), but sometimes we find intermittent problems in the MDL or CAST Lab. In these instances contact the instructional design team in the Office of Medical Education for assistance.

Registering a Clicker in *Blackboard*



NOTE: You only have to register a clicker one time, *Blackboard* will track it after that.

Step-by-Step Instructions

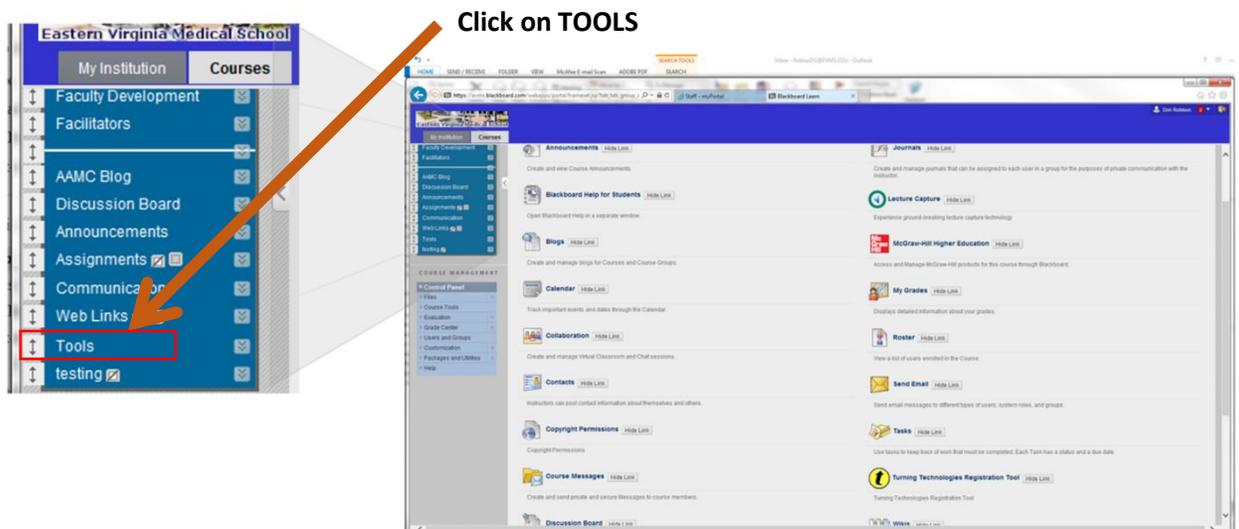
1. Locate the clicker identification number on the back of the response clicker.
2. Open *Blackboard*, and go to a course (any course will work).
3. Click on TOOLS on the left menu.
4. Scroll down, find the *Turning Point* Registration Tool, and click on it.
5. A class roster will come up.
6. Find your name.
7. Click on REGISTER RESPONSECARD DEVICE ID.
8. Enter your Device ID Number in the blank field and click UPDATE.
9. You will receive a confirmation screen indicating you have successfully entered your Device ID Number.
10. You're done! Now, your responses in classes requiring clickers will be registered.

Step-by-Step Instructions with Screen Captures

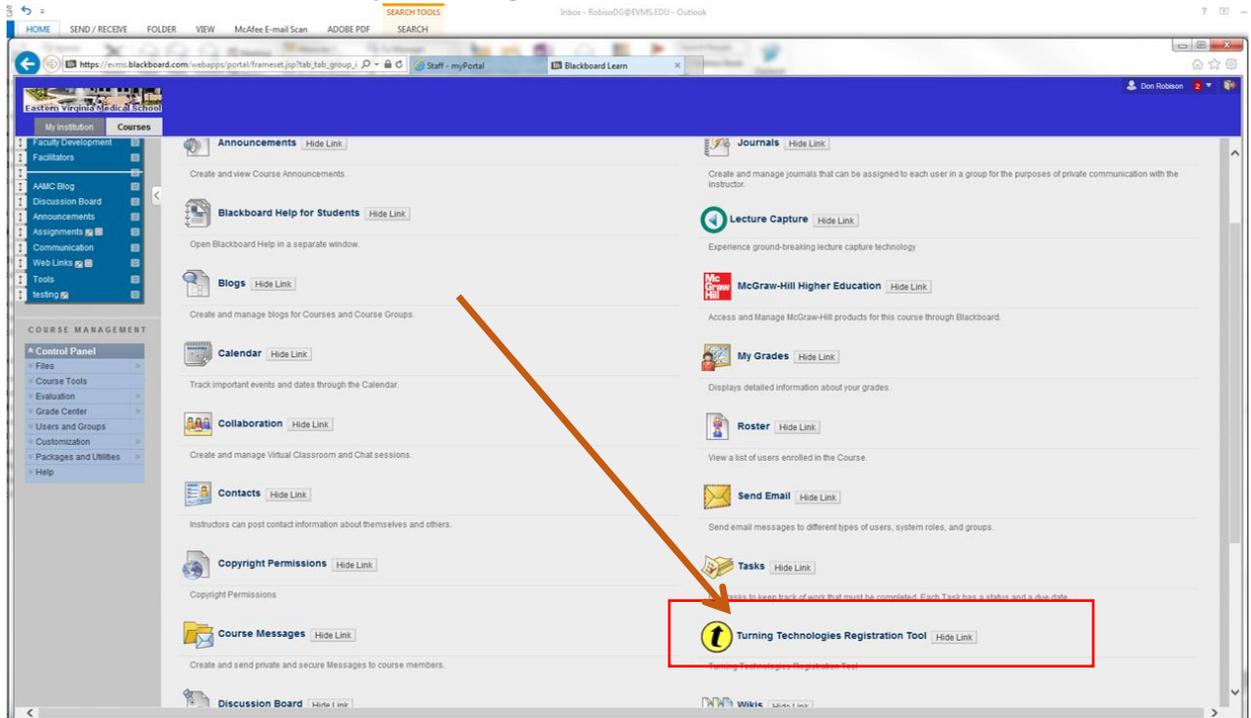
1. Locate the clicker identification number on the back of the response clicker.



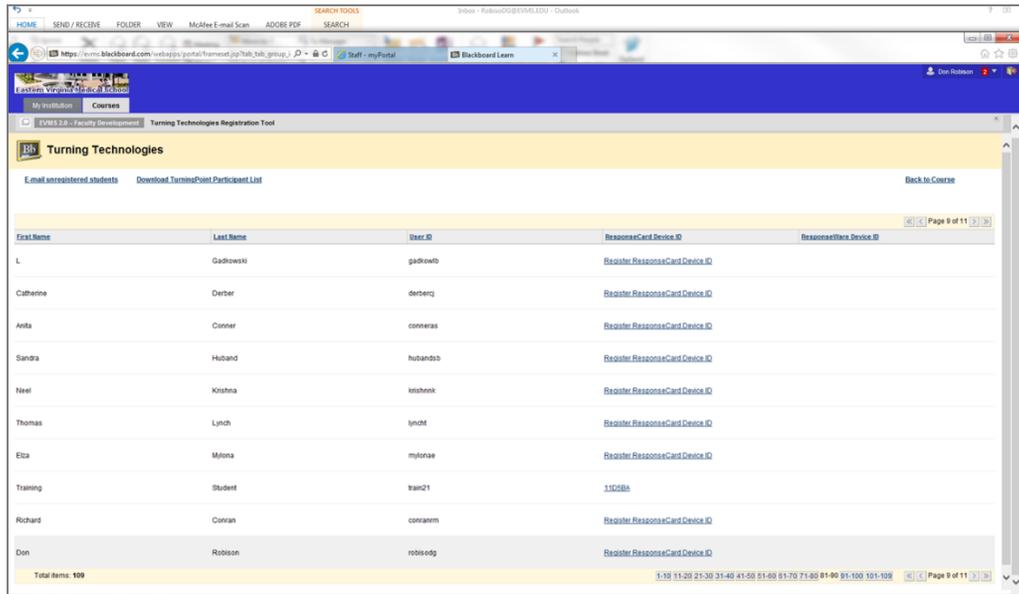
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4. Scroll down, find the *Turning Point* Registration Tool, and click on it.



5. A class roster will come up.
6. Find your name.



7. Click on REGISTER RESPONSECARD DEVICE ID.
8. Enter your Device ID Number in the blank field and click UPDATE.

Richard	Conran	conranrm	Register ResponseCard Device ID
Don	Robison	robisodg	A34323 <input type="button" value="Register"/> <input type="button" value="Cancel"/>
Total Items: 109		1-10 11-20 21-30 31-40 [1-50] 51-60 61-70 71-80 81-90 91-100 101-110	
https://evms.blackboard.com/webapps/bb2-Blackboard-TurningPoint-bb_b60/turningtool/index.jsp?startIndex=40&course_id=_3480_1			

9. You will receive a confirmation screen indicating you have successfully entered your Device ID Number.

The screenshot displays the Blackboard interface for Eastern Virginia Medical School. At the top, there is a blue header with the school's name and navigation tabs for "My Institution" and "Courses". Below this is a grey navigation bar with "EVMS 2.0 – Faculty Development" and "Turning Technologies Registration Tool". The main content area has a yellow background with the Blackboard logo and the text "Turning Technologies". Below that, another yellow section contains the Blackboard logo and the word "Status". The central white area displays the message: "The Response Device ID has been successfully registered." At the bottom, the date and time are shown as "Monday, December 9, 2013 10:42:11 AM EST".

10. You're done! Now, your responses in classes requiring clickers will be registered.

Using Clickers in Lectures

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Using Clickers to Engage Learners in a Lecture

Overview of this task: From time to time, you will want to ask a question in class and poll for the answer. There is one main question to ask here: Do you need to capture the data from the answers? If you don't need to capture the answers for future use, the task is very simple. In this case, you simply prepare the *Turning Point* question and present it. You will be able to display the results and discuss them with the class. On the other hand, if you do need to keep the results, the process is a little more complicated (but still relatively straight-forward).

This task consists of three parts:

1. Creating clicker questions
2. Presenting clicker questions
3. Deciding whether and how to use the data produced through the questioning

An Example: The Quick Question/Discussion/Re-question Approach

Dr. Damon asked a clicker question early in one of her lectures. Students responded, and she presented the student response results as a graph. She did all this from within the *PowerPoint* presentation for her lecture.

Then, after presenting the class results to the question, she had her students discuss the answer amongst themselves for less than two minutes and then, clicking on the "repoll" icon at the top the question slide, had students respond to the same question again. This time, almost all the students had the correct answer. She then discussed the other answers and told the students the reason for the correct one.

What's the value of this approach? First, having students respond to a question early gets them actively engaged in constructing an answer, and it helps them recall their prior study of the topic. Second, having them discuss the issue with others strengthens the schema of this concept and encourages a clinical type of reasoning. Having them construct a second answer engages them, and constructing the *correct* answer and then receiving *immediate* feedback significantly enhances future recall.



Presenting a Clicker Question

Overview of the Task: A clicker question is presented from within a class *PowerPoint* presentation. The question is actually one slide in the presentation. When you present the question slide, it becomes “live” and will receive student responses through a process called polling. When you are satisfied that all the responses have been made, you advance the *PowerPoint* slide normally, and the student response results are graphically presented. You can discuss this as you desire, and you can even go back and “re-poll” the same question.

Before the Presentation:

1. Create the clicker question and the presentation within which it will reside (see directions of page 15).
2. Plug in the Receiver.
3. Have the *PowerPoint* presentation with question on a USB drive and plug that in to the presentation computer.

The Steps:

1. Open the *Turning Point* software.
2. From within *Turning Point*, click on the CONTENT tab.
3. From the CONTENT drop-down menu, select NEW if you need to develop a question outside a presentation (directions page 15 of this handbook), OR
4. If you are using a question from an existing *PowerPoint* presentation on a USB drive (see directions page 21), from the CONTENT drop-down menu, select IMPORT and then select the presentation you have on the USB drive.
5. Advance to the slide containing the clicker question, and from *PowerPoint* presentation mode, the question slide will present with a ribbon banner across the top with a green indicator that looks like the one below. (This green indicator shows that the slide can receive student responses. In practice, our students know this and start responding immediately.)



6. If the ribbon banner has a red indicator, like the one below, you can click on the “re-poll” control on the ribbon banner and the slide will clear all prior data and re-open the question to receive responses. The indicator will turn from red to green.



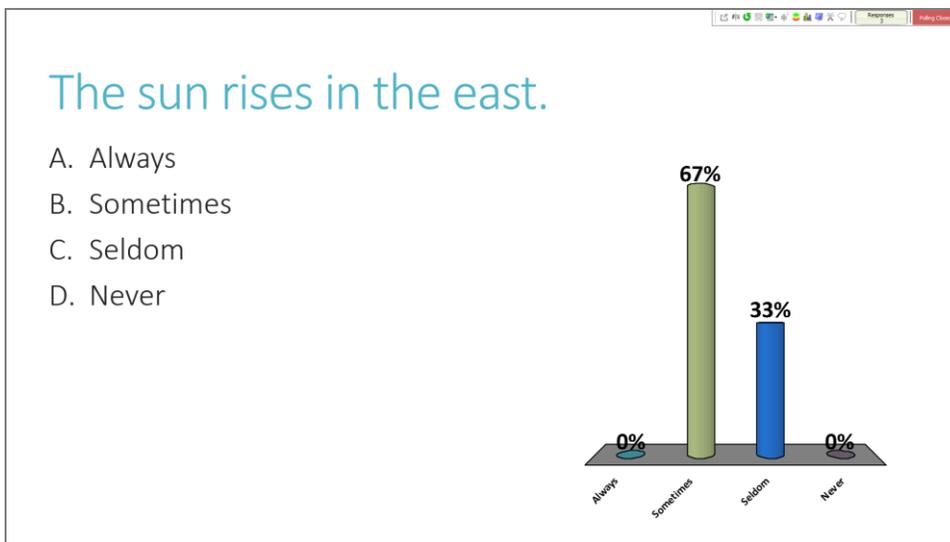
RE POLL ICON

If you see the red “Polling Closed” indicator on a slide, you may reopen polling by clicking on the “Repoll Icon” on the ribbon bar.

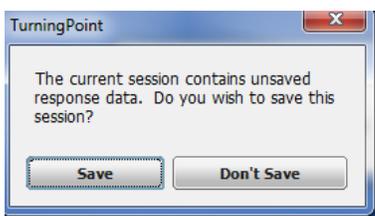
After you click the “Repoll Icon,” the indicator will turn green showing that polling has been reopened. Students can then respond to the question.



7. When you feel that you have received enough student responses, you may advance the slide as you would any other *PowerPoint* slide. When you advance the slide from the question slide, a graph presenting the student responses will appear like the one pictured below.



8. You can discuss the graph or provide feedback as you desire.
9. If you want to save the response data, you will be prompted at the end of the presentation to either “save the session” or not. Select SAVE THE SESSION if you want to keep the data.



Creating Clicker Questions from Scratch

The Steps:

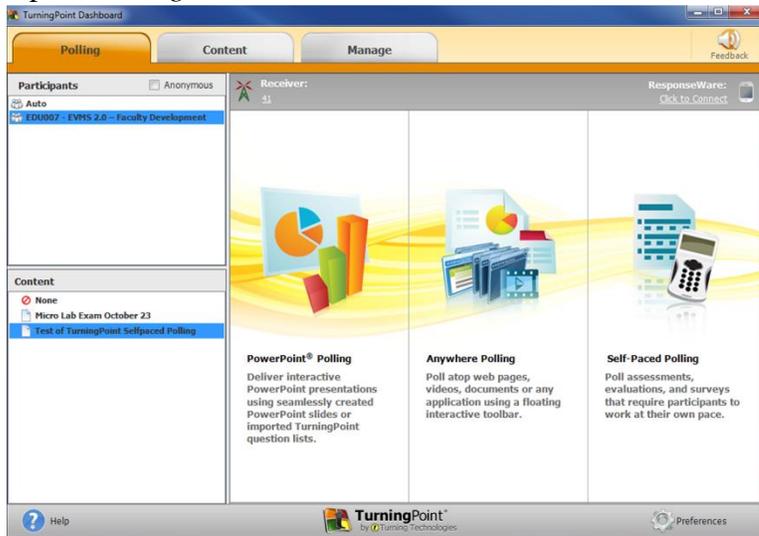
1. Open *Turning Point* software.
2. From within *Turning Point*, click the CONTENT tab.
3. Click on the CONTENT drop down to the left of the screen.
4. Select NEW and then POWERPOINT.
5. A new *PowerPoint* presentation will open.
6. *PowerPoint* will operate normally, so you can build your entire presentation from this point.
7. Once the *PowerPoint* presentation is open, you can select the location you want to insert the clicker question.

Think of the clicker question as simply one of your presentation's *PowerPoint* slides (only this one has a little more function to it).

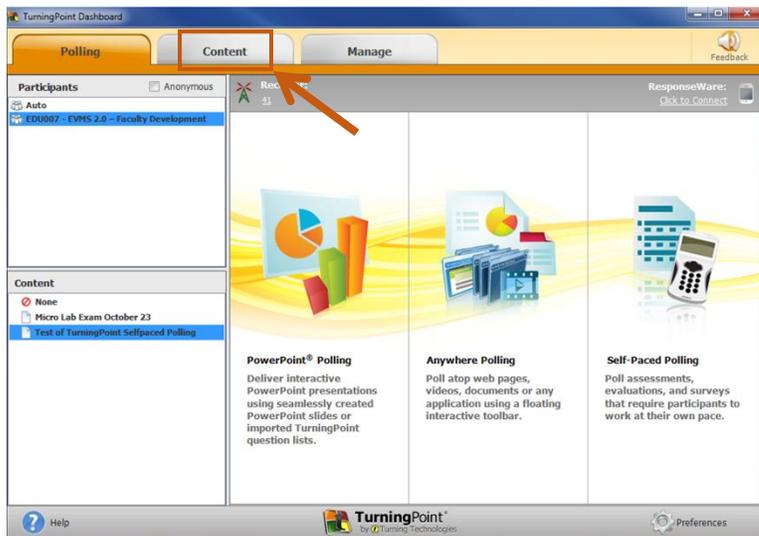
8. You will notice that the *PowerPoint* program displays a new tab: TURNINGPOINT. Open that tab by clicking on it. You add a new clicker question by clicking on the far left-hand icon entitled NEW. A drop-down menu will offer many choices for question types, we generally use MULTIPLE CHOICE questions, but you can see that there are many options there for you.
9. Use the question template to create the root question and answer choices.
10. If you want to identify the correct answer visually on the graph that is produced, you must select it in the ANSWER VALUES section to the right of the question template.
11. Make sure you save your work.

Step-by-Step Instructions with Screen Captures:

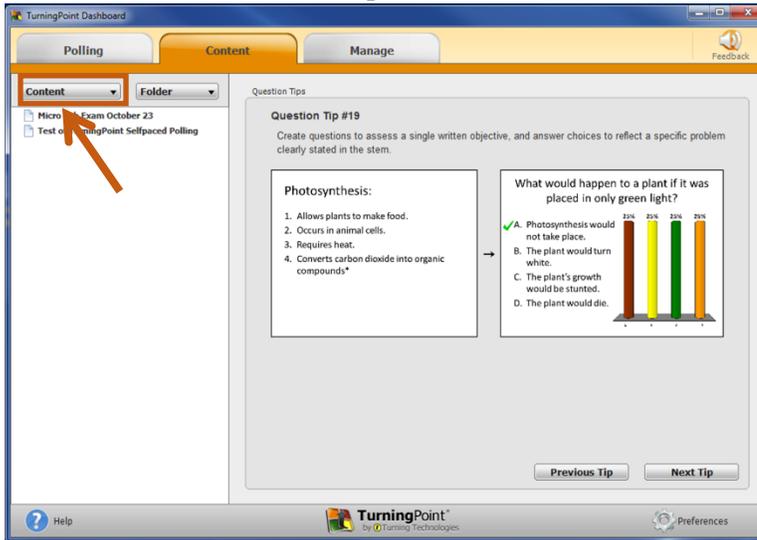
1. Open *Turning Point* software.



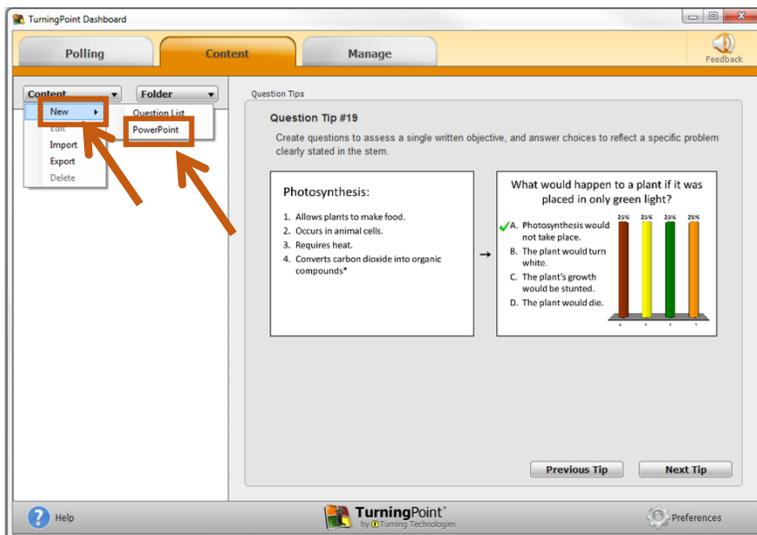
2. From within *Turning Point*, click the CONTENT tab.



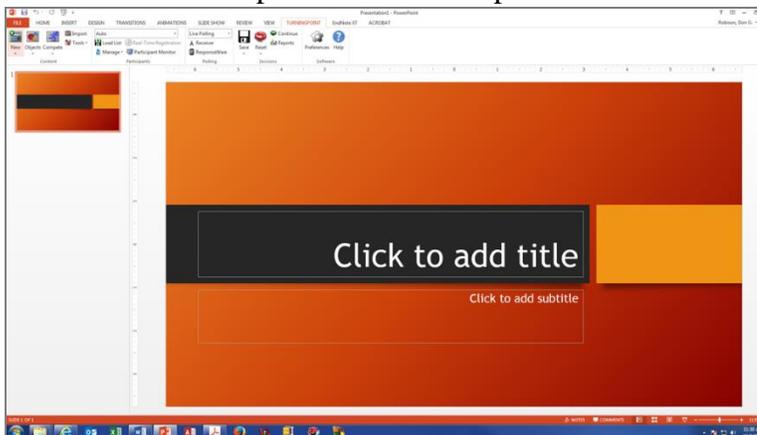
3. Click on the CONTENT drop down to the left of the screen.



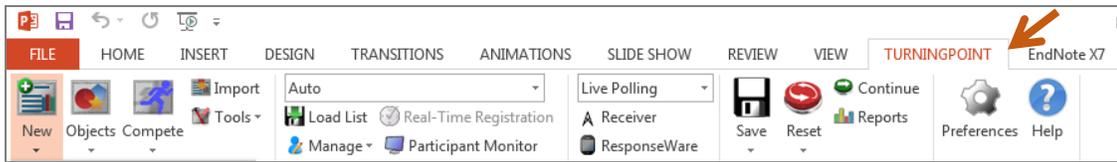
4. Select NEW and then POWERPOINT.



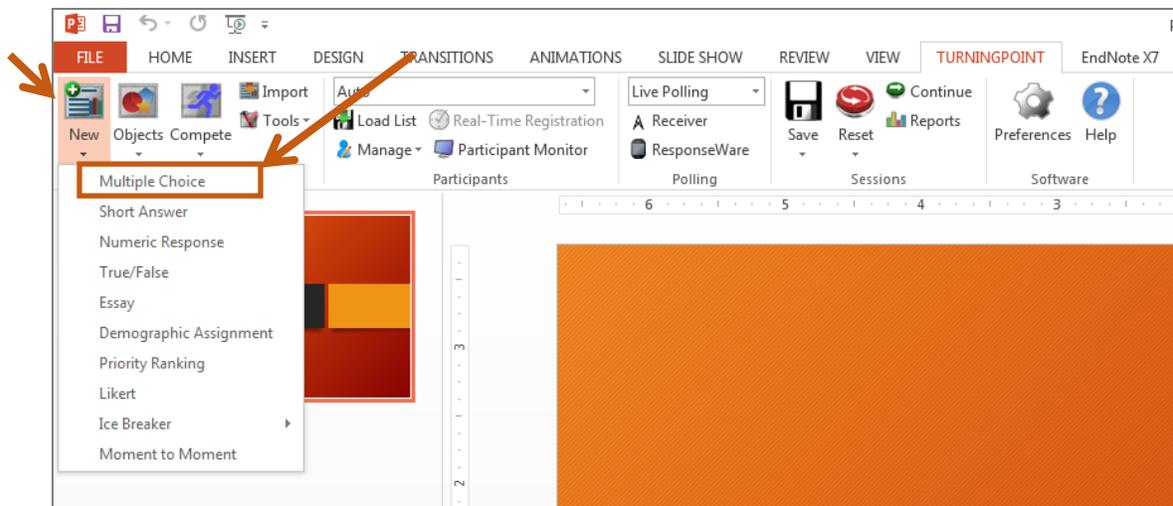
5. A new PowerPoint presentation will open.



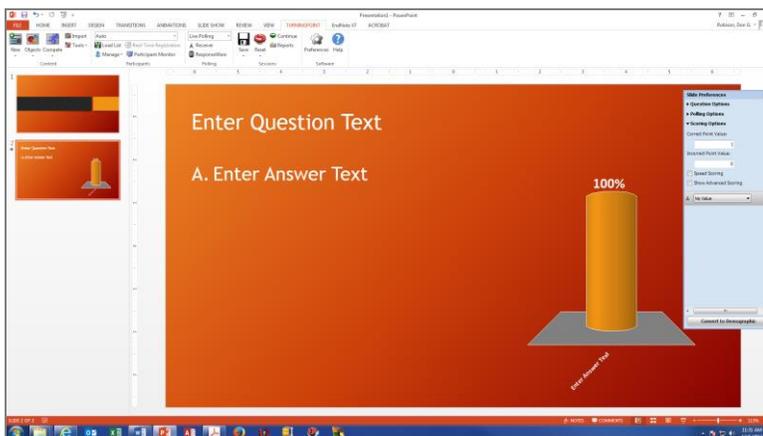
6. You will notice that the *PowerPoint* program displays a new tab: TURNINGPOINT.



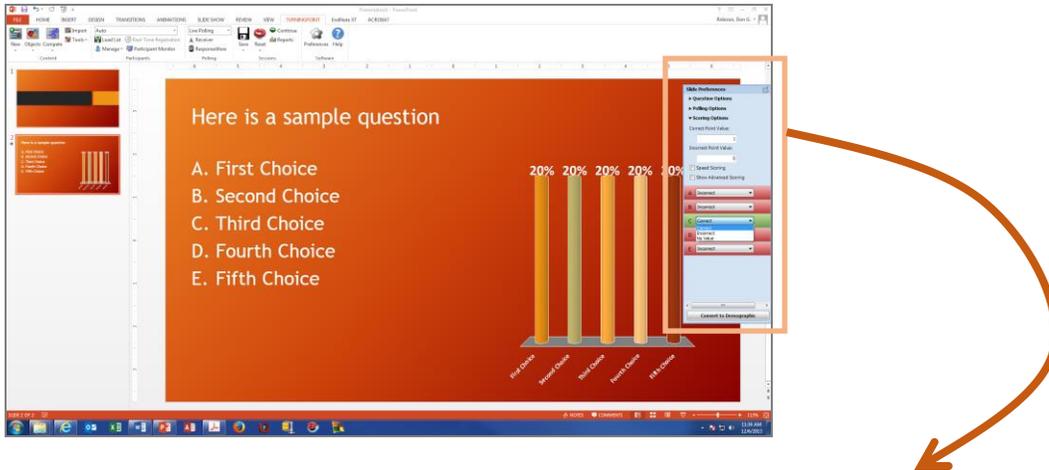
7. Open that tab by clicking on it. You add a new clicker question by clicking on the far left-hand icon entitled NEW. A drop-down menu will offer many choices for question types, we generally use MULTIPLE CHOICE questions, but you can see that there are many options there for you.



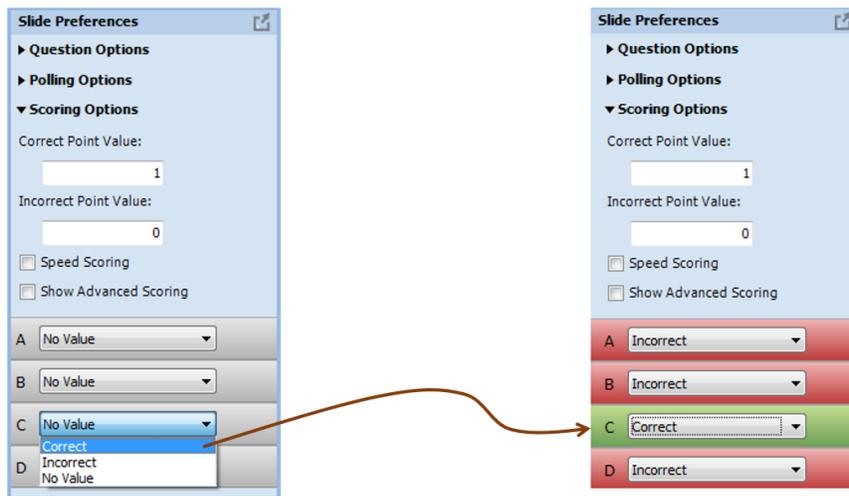
8. Use the question template to create the root question and answer choices.



- If you want to identify the correct answer visually on the *PowerPoint* graph that is produced, you must select it in the ANSWER VALUES section to the right of the question template.



When you identify an answer as the correct one, the other answer backgrounds turn red, and the correct answer background turns



- Make sure you save your work.

Adding Clicker Questions to an Existing *PowerPoint* Presentation

The Steps:

1. Open *Turning Point* software.
2. From within *Turning Point*, click the CONTENT tab.
3. Click on the CONTENT drop down to the left of the screen.
4. Select IMPORT and then POWERPOINT.
5. Select an existing *PowerPoint* presentation to edit.
6. Once the *PowerPoint* presentation is open, find the location you want to insert the clicker question and advance the slides to that position. TIP: It is easiest to use the presentation viewer to the left and click between the slides where you want the clicker question to go.
7. You will notice that the *PowerPoint* program displays a new tab: TURNINGPOINT. If it isn't already open, you can open that tab by clicking on it.
8. You add a new clicker question by clicking on the far left-hand icon entitled NEW. A drop-down menu will offer many choices for question types, we generally use MULTIPLE CHOICE questions, but you can see that there are many options there for you.
9. Use the question template to create the root question and answer choices.
10. If you want to identify the correct answer visually on the graph that is produced, you must select it in the ANSWER VALUES section to the right of the question template.
11. Make sure you save your work.

An Example: Questioning Throughout a Lecture

Dr. Shankaran had a mature presentation she often used for MIC202. She wanted to make it more interactive, particularly after reading the research on the value of questioning in learning experiences. She opened TurningPoint, imported her PowerPoint presentation, and inserted seven multiple choice questions that had students synthesize and apply what she was teaching.

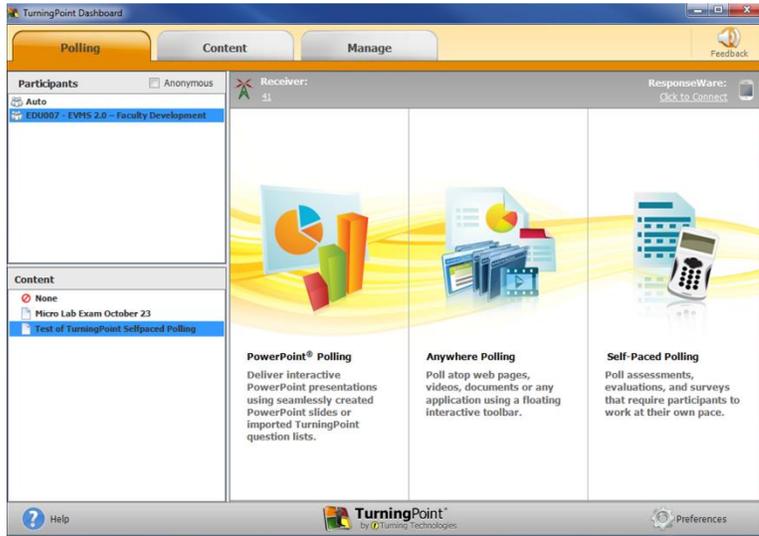
What's the value of this approach? First, there is always value in having students construct responses to questions (Wittrock, 1978). Second, by inserting questions throughout her lecture, she introduced variability, which is needed in the learning environment. Third, she took the content of her lecture from fact-presentation to application. Fourth, by placing her foundational science facts in an applied context, she provided the students with a schema to better remember the facts.

Remember: Knowledge does not exist outside of a context... it does not exist in a vacuum. Providing a clinical context for the facts a physician needs to know not only enhances future recall, but it is motivating.

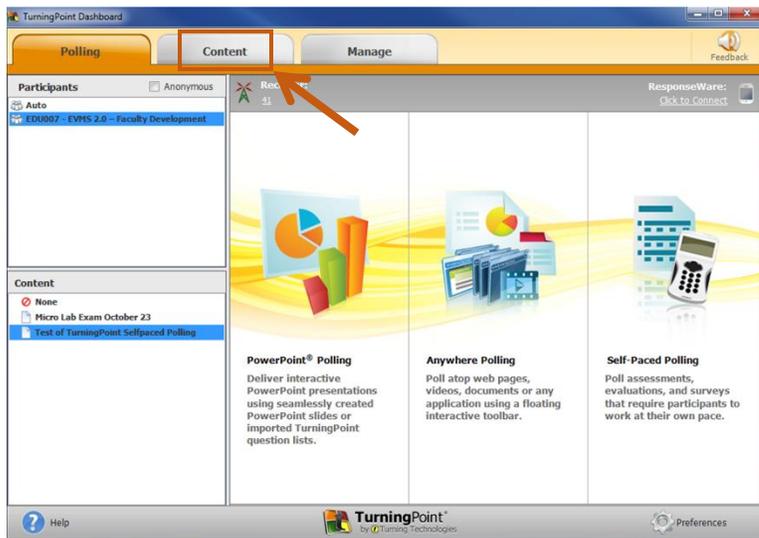


Step-by-Step Instructions with Screen Captures:

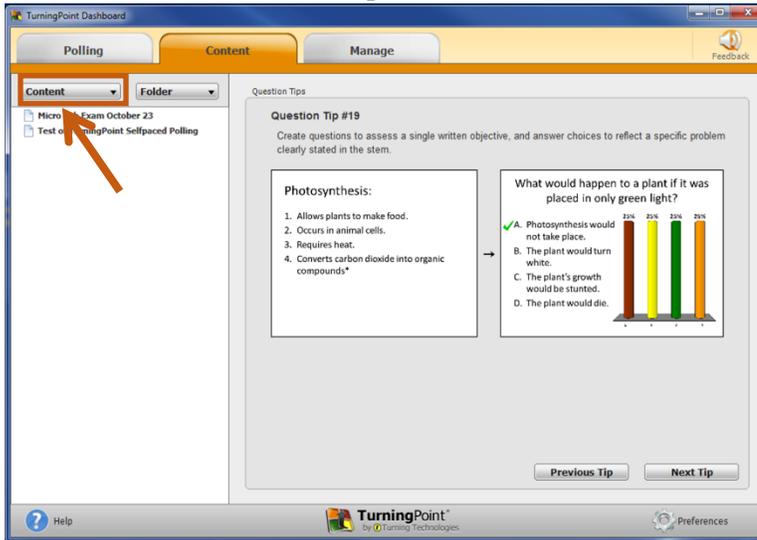
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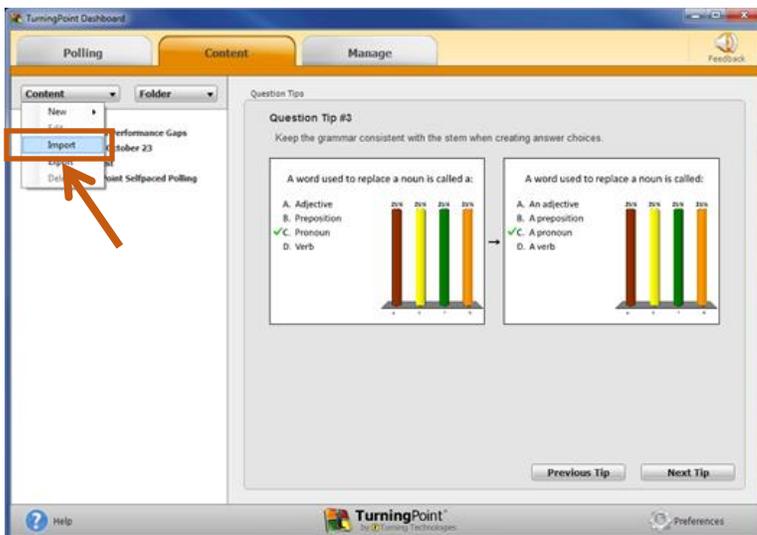
2. From within *Turning Point*, click the CONTENT tab.



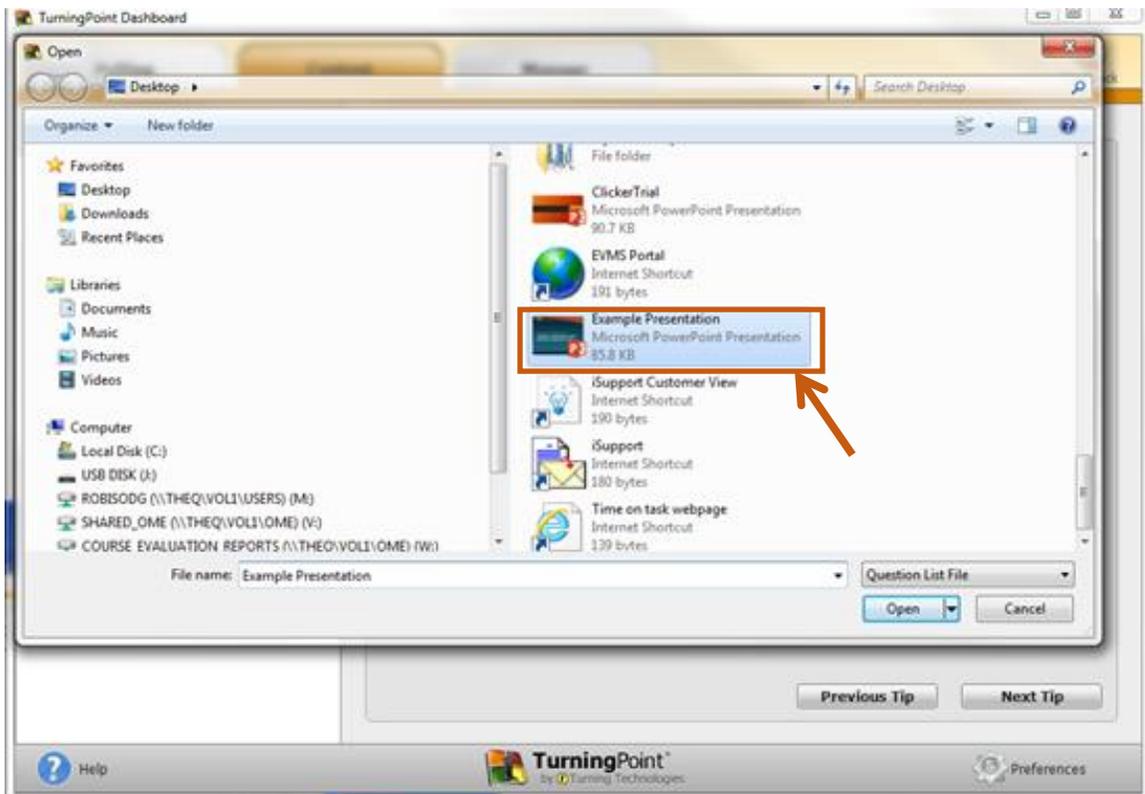
3. Click on the CONTENT drop down to the left of the screen.



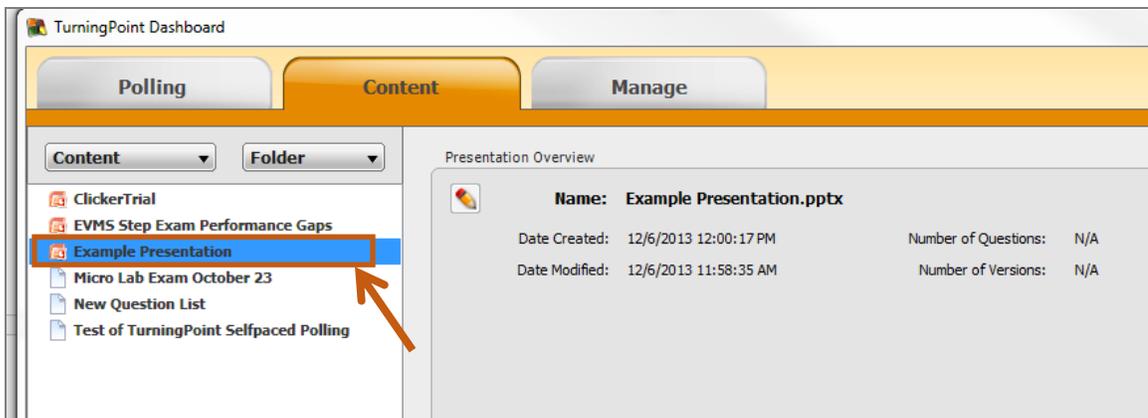
4. Select IMPORT and then POWERPOINT.



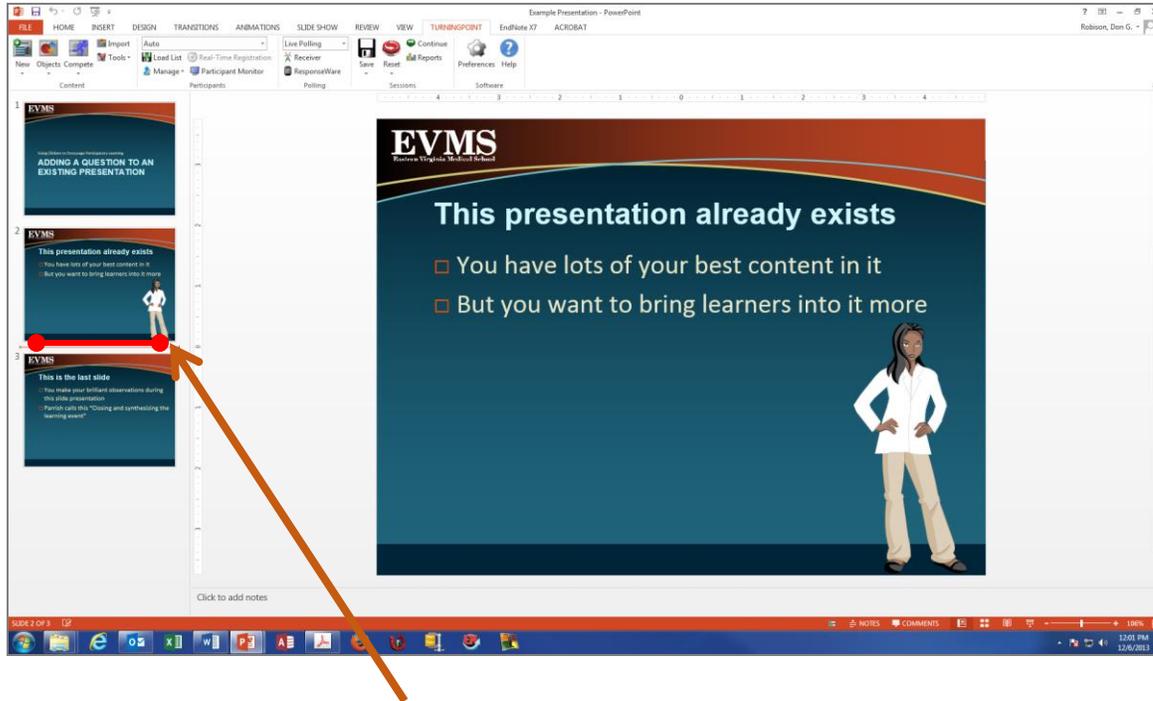
5. Select an existing *PowerPoint* presentation to edit. In this case, “Example Presentation.”



6. In the CONTENT tab, select the presentation you just imported. (In this example, we have chosen “Example Presentation.”)

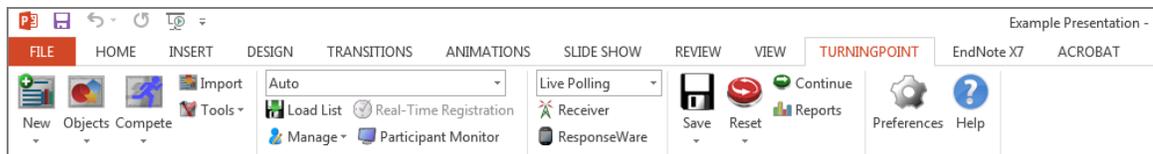


7. Once the *PowerPoint* presentation is open, find the location you want to insert the clicker question and advance the slides to that position. TIP: It is easiest to use the presentation viewer to the left and click between the slides where you want the clicker question to go.

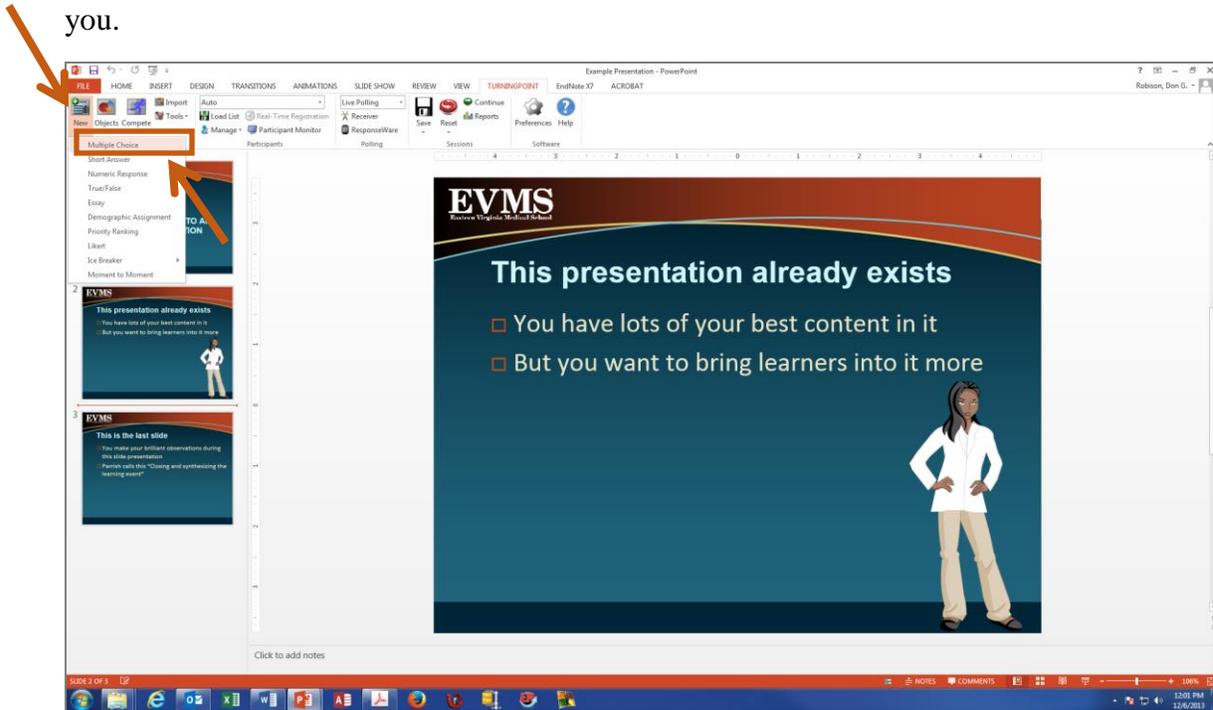


Insert slide where you want it. It is easiest to use the presentation viewer and click between the slides where you want the clicker question to go.

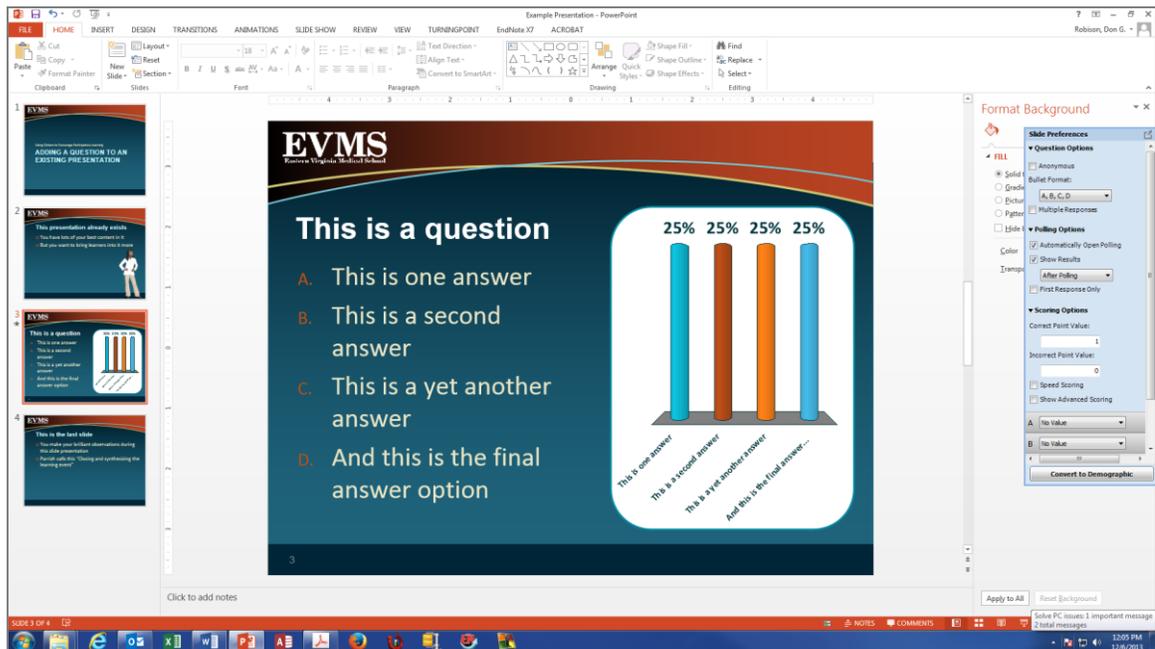
8. You will notice that the *PowerPoint* program displays a new tab: **TURNINGPOINT**. If it isn't already open, you can open that tab by clicking on it.



9. You add a new clicker question by clicking on the far left-hand icon entitled NEW. A drop-down menu will offer many choices for question types, we generally use MULTIPLE CHOICE questions, but you can see that there are many options there for you.

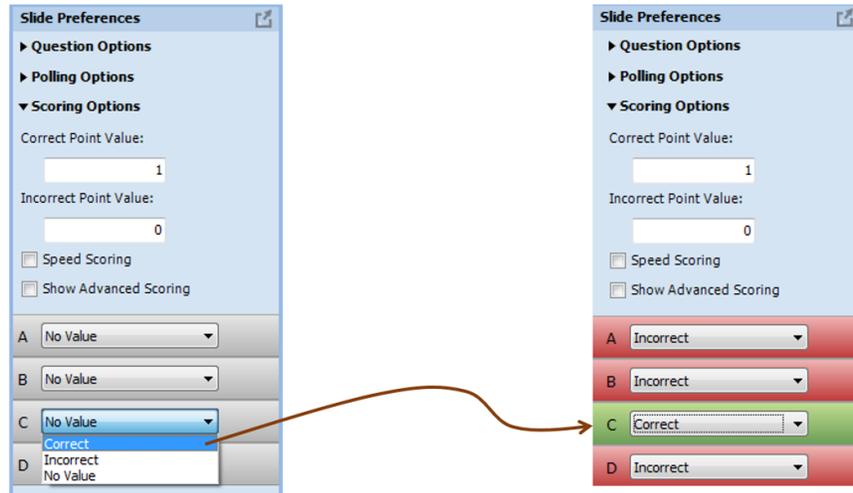


10. Use the question template to create the root question and answer choices.



11. If you want to identify the correct answer visually on the graph that is produced, you must select it in the ANSWER VALUES section to the right of the question template.

When you identify an answer as the correct one, the other answer backgrounds turn red, and the correct answer background turns



12. Make sure you save your work.

Using Clicker Questions to Take Attendance

Overview of this task: You can use the clicker to take attendance. We do this in conjunction with asking a clicker question. The important things in taking attendance are deciding when you want to take attendance, and then saving the data from your *Turning Point* session so we can bring the record in to *Blackboard*.

Some instructors prefer to use a clicker question early in the class and then one late in the class to take attendance, others choose only one question. It is up to you.

An Example: Questions That Take Attendance

Dr. Lynch takes attendance at his lectures (even though it isn't mandatory) and he uses clicker questions to do it. Shortly after the lecture session begins, he will ask a clicker question (fashioned after USMLE STEP I questions) that relates to the prior 30 minutes of lecture. Students respond, and Dr. Lynch presents the student response results and provides feedback. He may ask two to four questions during the class session.

Near the end of the lecture, he asks another clicker question, presents the results, and provides feedback.

He uses the responses to the first and final questions to capture attendance by saving the file and exporting it to *Blackboard*.

What's the value of this approach? From a learning perspective, it is always good to have students construct answers and then receive feedback. Using the same type questions they will see on the STEP I exam has obvious value. From an administrative perspective, it is a relatively painless way to account for student attendance—it takes zero additional class time.



The Steps:

1. Open the *Turning Point* software.
2. Click on the MANAGE tab.
3. Click on the PARTICIPANT LIST drop-down and select NEW.
4. Then, click on the SESSION drop-down and select DOWNLOAD FROM INTEGRATION.
5. Select BLACKBOARD from the drop-down menu.
6. In the SERVER ADDRESS field, enter: <http://evms.blackboard.com>
>then enter your EVMS username and password in the remaining fields.
7. Click CONNECT button at the bottom of the entry screen.
8. Select the course from which you want to import your participants.
9. The participant list will import and you will see the list in the window on the right hand part of the screen.
10. This participant list name will now also display in the Participants window on the left hand part of the screen.
11. To take attendance, you click on the participants list you desire in the left window (the background around it will turn blue).
12. Now you can present questions and poll the students and their response data will be recorded.
13. When you finish the session and close the *PowerPoint* presentation, you will be asked if you want to save the session data.
14. Select YES.
15. A new window will appear and you can name the session whatever you want and save it.
16. Contact Don Robison or Julie Bridges in the Office of Medical Education to upload the file to *Blackboard*. Or, you can try it by following the directions later in this handbook.

Using Clickers in Reviews

Using Clicker Questions During a Pre-Exam Review

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Using Clicker Questions During a Pre-Exam Review

Overview of the Task: This is a simple process that results in an effective learning experience. There is generally no need to worry about recording the results. Here, you simply distribute clicker questions throughout your exam review. Dr. Kerry's example below provides one way this can be done.

The Steps for Using Clicker Questions During a Pre-Exam Review

1. Identify good questions: focus on questions that require students to not only memorize, but also apply the information they have been taught. Developing a differential diagnosis, describing the steps for narrowing a diagnosis, or developing a treatment plan are examples of the kinds of tasks that are great for review questions.
2. Develop each question using the guidelines on page 21.
3. After presenting the question, provide feedback on why the correct answer is the right one, and you may want to address why some of the distractors are not. Focus here on distractor answers that attracted several student responses.

An Example: Pre-Exam Review Questions

Dr. Kerry uses clickers during her pre-exam reviews. She will develop two or three questions relating to each of the lectures included in the exam, and distributes them through the review session. There end up being between 20 and 30 questions for the entire review. She will ask the question, everyone responds, and then she provides feedback explaining why the correct answer is the right one, and why the others aren't.

What's the value of this approach? Generally in review sessions, we ask students questions and they think of the answer without having to really produce one. We provide feedback, and students nod in affirmation. *The problem is, students often get a sense they know things that they don't.*

This approach—using clicker questions—has students produce a specific answer and then receive feedback instantly. It solidifies the memory of correct answers, and also helps the student accurately identify areas of weakness.



Using Clickers in Assessments

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Using the Clickers to Give a Quiz (Polling)	45
Using the Clickers to Give a Lab Exam or Lab Quiz (Self-paced Polling)	47
Creating the Question List for a Lab Exam or Quiz	49
Importing a Participant List for a Lab Exam or Quiz	53
Giving a Lab Exam Using Clickers	55
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Using the Clickers to Give a Quiz (Polling)

Overview of this task: Some instructors use the clickers to administer small in-class quizzes at the beginning or the end of a class period. These generally consist of between three and five questions. Since the system already has the user identification data, you simply ask a series of clicker questions and the system will record the answers for each individual student. When you close the *Turning Point* session, you there will be a prompt asking if you want to save the session. You need to respond YES.

See page 41 for step-by-step instructions.

An Example: Using Clickers to Give a Short Quiz in Class

Dr. Lynch also uses clickers to administer short quizzes. These quizzes may only consist of three to five questions, and can also be used to take attendance.

These types of quizzes are announced, and will count as a minor part of a student's grade. They can be given at any point during a class session, but are generally given early in the session. Feedback can be provided immediately following the quiz. Student responses are saved, automatically graded, and uploaded to *Blackboard* after the class session.

What's the value of this approach? These types of quizzes provide a winsome amount of accountability and have proven to improve student performance in laboratory research. Used in conjunction with immediate feedback, they also carry the learning value that student constructed responses with immediate feedback provides.



Using the Clickers to Give a Lab Exam or Lab Quiz (Self-paced Polling)

Overview of this task: You can use the response clickers as the primary means for students to respond to questions in a lab exam or quiz. A self-paced polling test is a practical test in which students walk around a lab and answer questions posed in relationship to numbered displays. These questions are often *identify*-type questions, but with some forethought can be process or diagnosis questions.

These questions are often *identify*-type questions, but with some planning can be application or diagnosis questions.

Typically, there are numerous (50 - 80) stations in the lab, and students start at a particular numbered display. One of the first things the student must do is scroll through the questions on his or her clicker to arrive at the starting question corresponding to his or her starting display.

In practice, the most important times for students to have a clicker connection are at the beginning of the test and at the end when the test is submitted.

An Example: Using Clickers for a Lab Exam

Dr. Goodmurphy uses clickers in lab exams. Students walk around to different stations—each station corresponds to a question—and at the station the student reads a multiple choice question and uses the clicker to respond. Creating the exam beforehand takes a little more time than it would have without clickers.

When the student has completed all the questions, the answers are submitted from the clicker. The student receives the exam grade instantly.

What's the value of this approach? There are two chief benefits to this approach: first, for the instructor, grading is automatic. Most of the instructor's labor is prior to the exam. Second, students receive their grades instantly. The grades are in a digital format and may be uploaded to *Blackboard* or forwarded within our EVMS formal exam system easily.



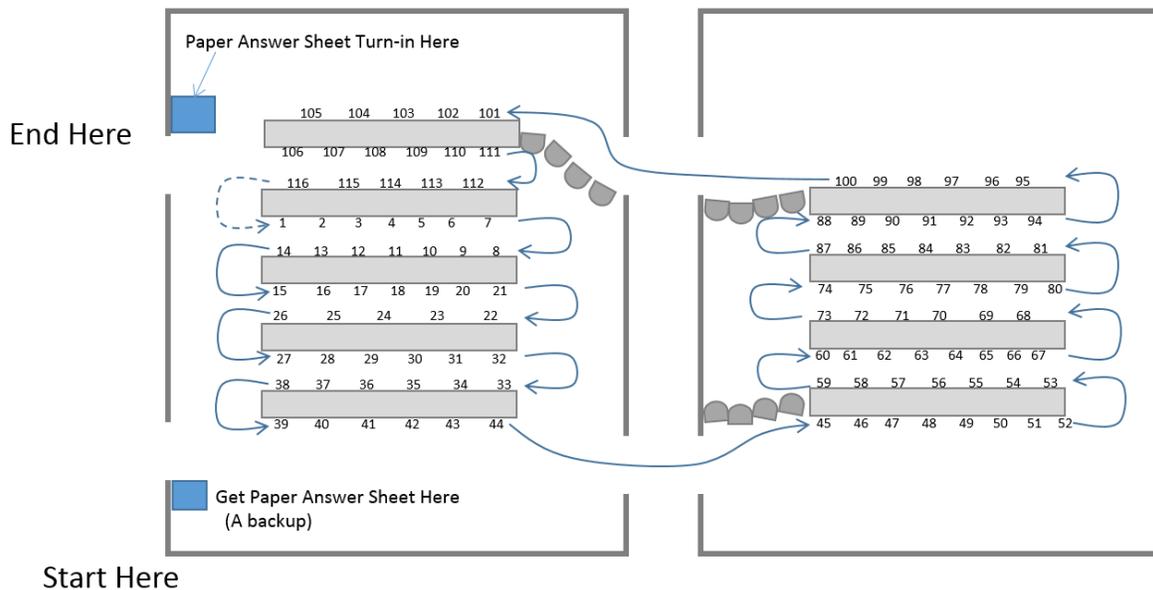
Building the Lab Exam or Quiz

1. **The first step is planning the course the students will follow during the exam** (see the example on the next page)
2. **The second step is writing the questions and developing the answer key.**
3. **The third step is creating the “Question List” in *Turning Point*** (click here for details).
4. **The fourth step is importing a “Participant List” from *Blackboard*** (click here for details).
5. **Next, the Question List and Participant List are selected, and the test may begin.**
The rest of the slides in this presentation present the process for giving the test and saving the session file.

A Typical Layout for a Self-paced Lab Exam (MDL)

A Typical Self-paced Polling Exam Setup and Test Taker Route

1. Students start at all the stations. They must enter the number of their start station in their clicker when they begin the test. They continue around the stations until they arrive at that starting station again.
2. The students need to keep a paper copy they turn in. This acts as a safety backup.
3. Students typically stay at each station for 60-90 seconds.
4. Chairs are often used to clarify the “exam path.”
5. Stations are clearly numbered. The question associated with a station is usually presented on an index card taped in the vicinity. (Note: Make sure the question and multiple choice options are clear.)

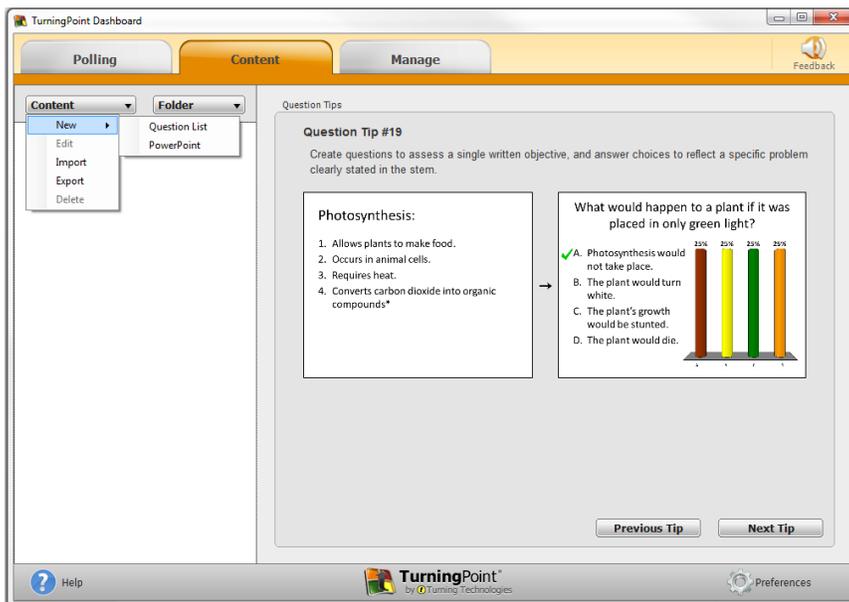


Creating the Key for a Lab Exam or Quiz

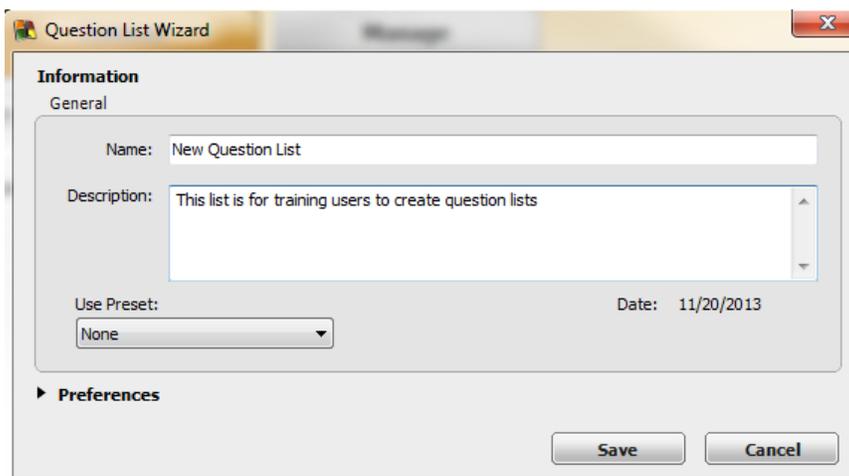
Overview of Task. In Turning Point, a key is called a “Question List” and it is a file that contains questions and the answers to the questions. You create a question list anytime you give a lab exam or lab quiz using the clickers.

The Steps...

1. Select the CONTENT tab.
2. Then, click on “Content” drop-down menu.



3. Mouse over NEW and select QUESTION LIST. The Question List window will then open.



4. Enter a NAME and brief DESCRIPTION for the question list in the blanks provided.

5. Click the **ARROW** next to Preferences to open the window and adjust the options as necessary in the *Content* and *Polling* sections.
6. Click **SAVE**.
7. For each multiple choice question follow these directions:

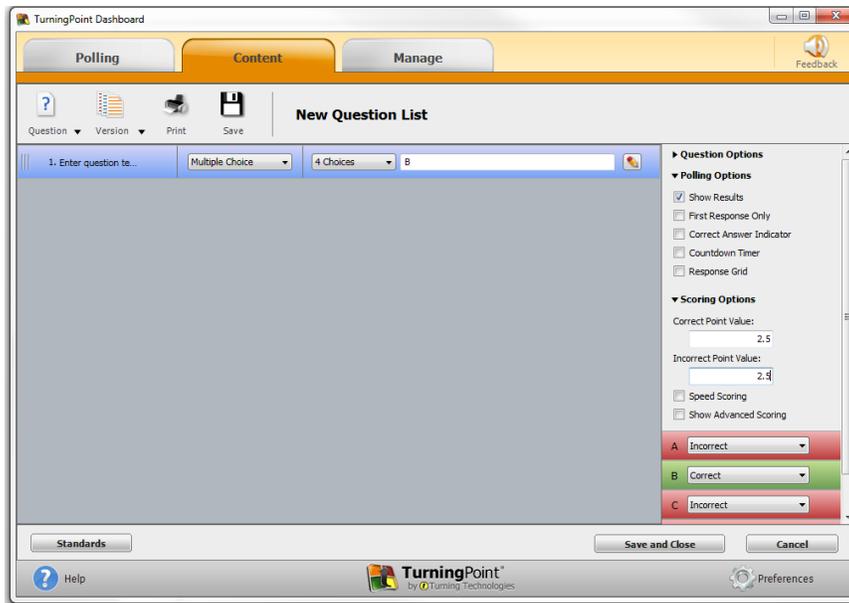
For Each Multiple Choice Question

1. Choose the question type. We generally select **MULTIPLE CHOICE**, but you can choose other types.
2. Then, choose the number of answer choices.
3. Then, in the lower right-hand part of the screen, click on the correct answer and select **CORRECT**.

The image contains three screenshots of the TurningPoint Dashboard 'New Question List' interface, illustrating the steps to create a multiple choice question:

- First Screenshot:** Shows the 'New Question List' window with the 'Multiple Choice' option selected in the 'Enter question type' dropdown menu. An arrow points from the first instruction to this dropdown.
- Second Screenshot:** Shows the 'New Question List' window with 'Multiple Choice' selected and '4 Choices' selected in the 'Enter number of choices' dropdown menu. An arrow points from the second instruction to this dropdown.
- Third Screenshot:** Shows the 'New Question List' window with 'Multiple Choice' selected, '4 Choices' selected, and 'B' selected as the correct answer in the 'Correct Answer' dropdown menu. An arrow points from the third instruction to this dropdown.

8. When you have completed constructing the question, the screen should look like this (note that the correct answer is highlighted with a green background).



9. To create more questions, click on the QUESTIONS icon at the top left of the screen and repeat the process. When you are finished, click SAVE AND CLOSE at the bottom right of the screen.

CAUTION: You are strongly encouraged to create a new answer key for each clicker test. See the cautionary tale below.

A Cautionary Tale: Create a New Key for Each Clicker Exam

Dr. Wellman uses clickers for her lab exams. Once, she edited an answer key she had used before and tried to use it on a new exam. The key presented correctly in the software in her office. She brought that file key to the laptop she used to administer the exam in the CAST Lab and found that it was incorrect. Fortunately, she discovered the issue prior to administering the exam and so was able to respond to the problem.

The moral of this story... The moral of this story is that unless you are using the same answers, it is prudent to operate from a new key.

Why did this occur? It appears that the *Turning Point* software maintained a copy of the exam file with the same name as the edited file and operated off of that file on exam day.

Thanks Dr. Wellman for letting us share this tale!

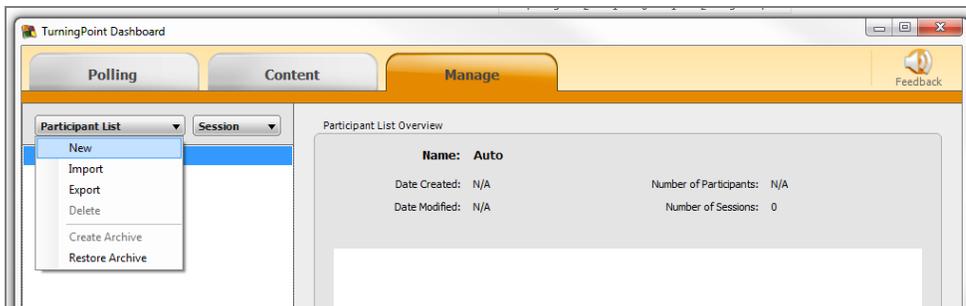


Importing a Participant List for a Lab Exam or Quiz

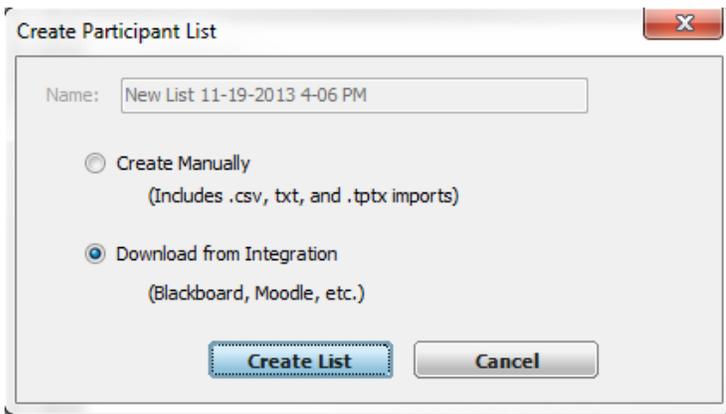
Overview of Task. To give a lab exam or quiz using the clickers you need two things: 1) the question list (the steps are available on the previous page), and 2) the participants who will be taking the exam.

The Steps...

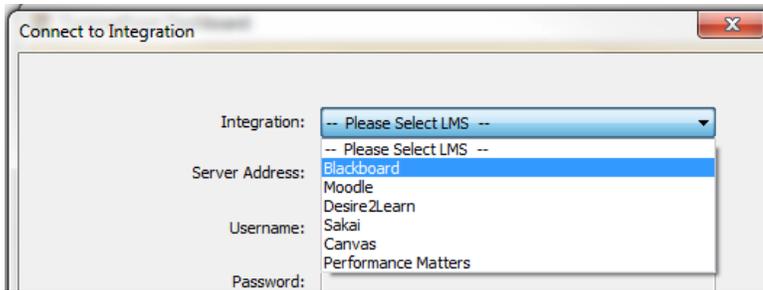
1. Open the *Turning Point* software.
2. Click on the MANAGE tab.
3. Click on the PARTICIPANT LIST drop-down and select NEW.



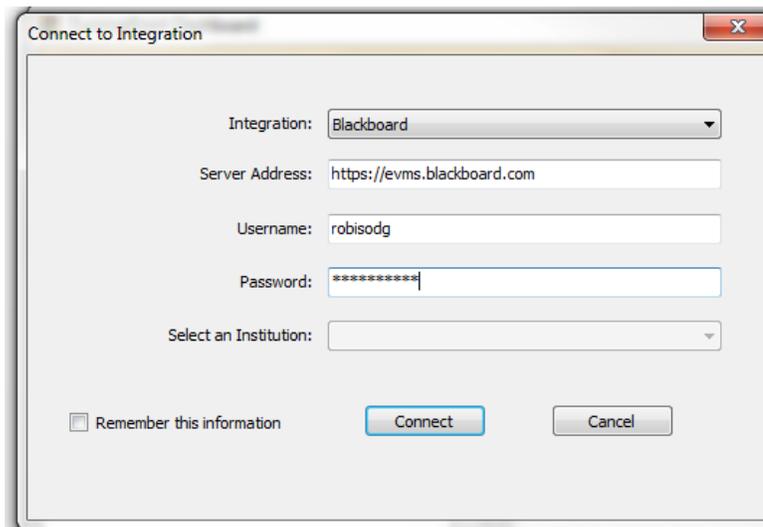
4. Then, click on the SESSION drop-down and select DOWNLOAD FROM INTEGRATION.



5. Select BLACKBOARD from the drop-down menu.



6. In the SERVER ADDRESS field, enter: <http://evms.blackboard.com>
>then enter your EVMS username and password in the remaining fields.



7. Click CONNECT button at the bottom of the entry screen.
8. Select the course from which you want to import your participants.
9. The participant list will import and you will see the list in the window on the right hand part of the screen.
10. This participant list name will now also display in the Participants window on the left hand part of the screen.
11. Click on the participant list and the background will turn blue. You have selected your participants. Great job!

Giving a Lab Exam Using Clickers

Overview of the Task: You can use the response clickers as the primary means for students to respond to questions in a lab exam or quiz. A self-paced polling test is a practical test in which students walk around a lab and answer questions posed in relationship to numbered displays.

To give a lab exam, you are three major steps:

1. Identify the participants for the exam or quiz
2. Identify the question list for the exam or quiz
3. Start and stop the polling

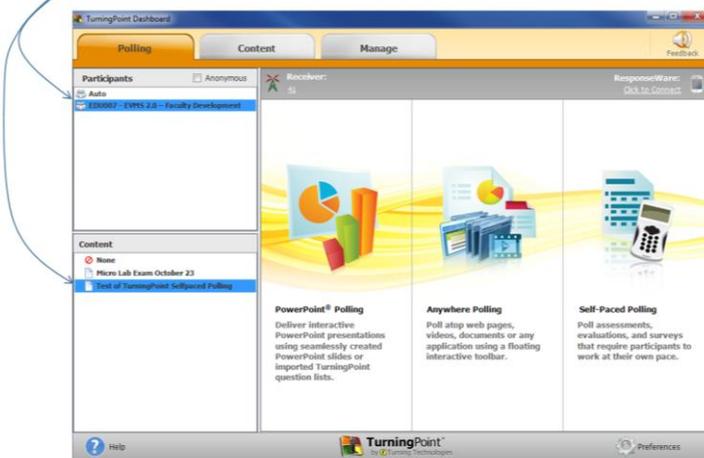
Before the Exam:

1. Create the Question List as described on page 35 of this handbook.
2. Import the Participant List for the group that you will test (see directions on page 36 of this handbook).

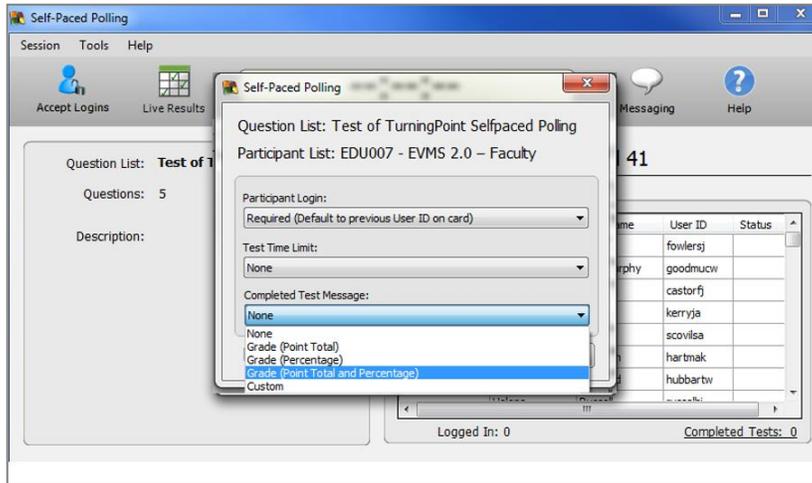
The Steps:

1. Plug in the receiver.
2. Click on both the Question List and Participant List you will use for this exam or quiz.

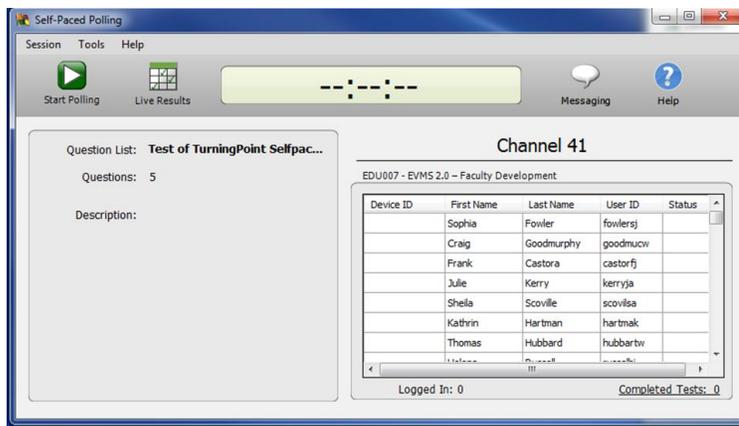
2. When this screen comes up, click on your participant list *and* question list. (A blue highlight bar will let you know they are selected—see example below)



3. Click on the Self-Polling section in the *Turning Point* software.
4. Select login option from the “Participant Login” drop-down menu. You will select OFF from the drop-down menu selections.
5. Set Time Control to NONE.
6. Set completed test message to your preference. Almost always, we select POINTS & PERCENTAGE, but if your exam is taking place in two labs (GAL and CAST for example), you should select NONE.



7. Click OK
8. On the next screen, you will see a green START arrow, click on it, and the exam begins. [At this point, students will start checking into the exam with their clickers.]



9. You may view the progress of the exam, and see if it is working properly, by selecting the LIVE RESULTS option on the top menu. [This will provide you with a view of all the students and the questions they have answered. It will also display correct and incorrect answers. If you mouse over the answers, a pop-up will appear showing you their actual answers. This is a great way to get an early indication that a question is not a good one.]
10. You close the test by clicking on the red STOP icon in the upper left of the screen. You will be prompted to save the session. You want to save the exam file to a place where you know you can get to it. The Office of Medical Education will often handle this aspect of the test processing for you.



Recording the Exam or Quiz Results

Overview of the Task: There are two ways we handle exams and quizzes using the clickers.

1. **When the exam or quiz counts for a significant portion of a student's grade**, the exam should be handled within the EVMS Student Performance and Evaluation guidelines. In these cases, the test result files are transmitted to the office of Student Performance and Evaluation. These results are then imported into *ExamSoft* and detailed reports can be generated.
2. **When the quiz counts for an insignificant portion of a student's grade**, you handle it as you would any other assignment. The grades can be automatically graded (provided you set up the polling identifying correct answers) and uploaded directly into *Blackboard*.

The Steps for Uploading Grades to *Blackboard*:

Turning Point calls this “Exporting sessions to a LMS Integration.” Or, you can think of it as uploading your results into *Blackboard's* Gradebook.

1. Since you created the participant list for your clicker quiz by downloading it from *Blackboard* in the first place, the *Turning Point* software ‘knows’ which class it will be sending the results to.
2. To upload your clicker session results, first open *Turning Point*.
3. From the “Manage” tab, click “Results Manager”
4. Click the “Integrations” icon in the upper left-hand part of the screen.

(continued on next page)

5. The Connect to Integration window appears. Think of this as the point where *Turning Point* and *Blackboard* meet.

Connect to Integration

Integration: -- Please Select LMS --

Server Address: -- Please Select LMS --

Username: Moodle
Desire2Learn
Sakai
Canvas
Performance Matters
Web Registration Tool

Password:

Select an Institution:

Remember this information

Connect Cancel

6. Complete the form as pictured below.

Connect to Integration

Integration: Blackboard

Server Address: https://evms.blackboard.com

Username: robisodg

Password: *****

Select an Institution:

Remember this information

Connect Cancel

7. On the next screen, select EXPORT SESSION and select the exam file from the test you just administered.

Update with Integration

Update Participant List

Export Session(s)

Select Columns to Export:

Test of TurningPoint Selfpaced Polling 11-20-2013 11-06 AM

TurningPoint Total Performance

TurningPoint Total Attendance

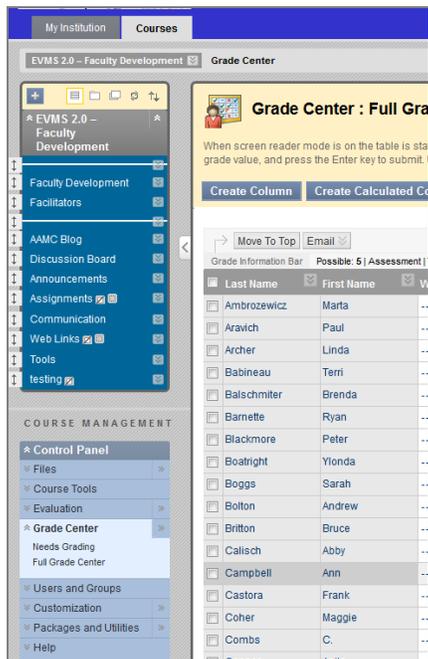
TurningPoint Total Points

Select All

Active Participants Only

Back Export Cancel

8. The software will ask you if you want to export that data (which is odd, because you just indicated you wanted to...). Select EXPORT.
9. The newly exported grades will show up in *Blackboard* in the GRADE CENTER in the far right column.



The screenshot displays the Blackboard Grade Center interface. The top navigation bar includes "My Institution" and "Courses". The main header shows "EVMS 2.0 - Faculty Development" and "Grade Center". A left-hand navigation menu lists various course management tools, with "Grade Center" expanded to show "Needs Grading" and "Full Grade Center". The main content area is titled "Grade Center : Full Gra" and contains a table of student names and their grades. The table has columns for "Last Name" and "First Name".

Last Name	First Name
Ambrozewicz	Marta
Aravich	Paul
Archer	Linda
Babineau	Terri
Balschmitter	Brenda
Barnette	Ryan
Blackmore	Peter
Boatright	Yionda
Boggs	Sarah
Bolton	Andrew
Britton	Bruce
Calisch	Abby
Campbell	Ann
Castora	Frank
Coher	Maggie
Combs	C.

Increasing Participation in Lectures

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Twenty Ways to Make Lectures More Participatory Harvard's Bok Center for Teaching and Learning	69

Increasing Student Participation in Lectures: The Value of Questions

Whether you use clickers or not, effective lectures require students to actively participate. Harvard's Bok Center for Teaching and Learning (HBCTL) (2010) published an excellent guide suggesting 20 ways to make lectures more participatory (Included as Appendix B). HBCTL divides their suggestions into five different areas that are helpful in our current discussion: beginning a lecture, inviting participation, punctuating the lecture with questions, varying the format, and closing the lecture.

The following ideas use HBCTL's participatory lecture strategies, and provide examples for the use of clicker questions that will encourage student participation.

As a general value, create clicker questions that integrate and apply knowledge in clinical settings. Great clicker questions serve our higher purposes. We are trying to develop a clinical mind in our students. At EVMS, we want to integrate the practice of medicine wherever it is appropriate. Therefore, as you consider clicker questions, consider questions that apply foundational or taught knowledge or processes in an applied clinical context. Consider using vignette or even USMLE STEP I type questions.

Create clicker questions that integrate and apply knowledge in clinical settings.

Gain Attention and Stimulate Curiosity. Job one in teaching is gaining the students' attention. Keller (2009), a leading researcher in learner motivation, proposes that this is best done through stimulating cognitive curiosity or a sense of mystery. At the opening stages of class, use the clickers to ask the following kinds of questions:

- Questions that draw on any preparatory reading or prerequisite classes.
- Questions about personal opinions related to the topic before entering it.
- Questions that require two minutes of small group or partner discussion.
- Questions that create a sense of surprise or challenge expectations.

The lecturer may choose to provide feedback, or better, ask students to provide feedback to the answers that are elicited.

Invite Participation. To invite participation you have to approach the class in a way that creates a sense of ease (see the HBCTL Suggestions). Inviting participation is about how you interact with the students. If you use a conversational tone and accept answers, and if you actually look at students as they speak, they will generally participate. Further, you can invite them to take opposing views to yours, or you can have students respond to students.

Punctuate the Lecture with Questions. Rather than drone on and on (I know, that sounded more negative than I meant it)... Get students involved. Here are some clicker tactics that may help:

- Ask questions throughout the lecture, so that the lecture becomes more of a conversation.
- Ask students to respond to clicker questions throughout the lecture. From time to time, call on people to explain their views. Vary the type of question—you may ask a foundational knowledge question, then follow up with an integrated problem that includes the foundational knowledge. Remember: A multiple choice question, when crafted carefully, can get you to the highest levels of Bloom's taxonomy.
- Ask questions with surprising answers. This wakes students up and keeps them in the game.
- Pause after you make a major point in the lecture, and then ask a clicker question to solidify the point.
- Have students interact after a clicker question for 2 minutes, then ask the same question again.
- When showing a picture, ultrasound image, video or other graphic, have the students tell what they see. You can show the image or clip, then ask a clicker question. Consider having the students discuss it with their neighbors and answering the question again (give them 2 minutes for this discussion).

What is happening from a learning perspective here? The evidence is that when students construct answers (rather than having the answers told to them), develop meaning together by discussing problem solutions, interact with content multiple times, and receive feedback from instructors or peers along the way, we engage metacognitive skills and also realize a deep level of schema formation (Bruning, Schraw, Norby, & Ronning, 2004).

The value of immediate feedback. Researchers from divergent perspectives have demonstrated the huge positive impact of immediate feedback on learning (see Dempsey, Driscoll, & Swindell, 1993; Kulhavy, 1977; Kulik & Kulik, 1988). Kulik and Kulik (1988) concluded from their metanalysis of feedback research by observing that in study after study, immediate feedback was shown to be very effective in improving learning. The behaviorist B.F. Skinner (1968), for example, believed that the most important variable in learning is the feedback one receives after performing a behavior, he believed that the feedback received by the performer after an action will dictate the future of that behavioral performance. Kourlisky (1993) studied the effects of immediate feedback from a more cognitive perspective, studying how feedback effected student performance with complex information or misconceptions. Kourlisky found that feedback effects were significant in improving test performance. Taken together, we conclude that immediate feedback serves two purposes: first, it corrects misconceptions before they solidify; and second, feedback helps facilitate understanding of complex information or processes.

Selected Applied Generative Research Studies (from Grabowski, 2004)

Table 1: Brief Summaries of Selected Applied Generative Research Studies (from Grabowski, 2004)

Generative Activity	Author/Year	Results
Underlining	Rickards & August (1975)	Increased achievement on posttest when learner underlined relevant information.
Note taking	Peper & Mayer (1986)	Note taking increased achievement for far-transfer problem solving but not near-transfer fact retention.
Writing summaries during note taking	Davis & Hult (1997)	Summary group scored significantly higher on free recall and delayed retention test.
Adjunct questions	Anderson & Biddle (1975)	Better learning with more frequent questions. Overt responses needed depending on if questions were embedded
Adjunct questions: super-ordinate postquestions	Woods & Bernard (1987)	More main ideas were recalled. General questions were more engaging than detailed questions.
Organization headings	Doctorow, Wittrock & Marks (1978)	Learner-generated sentences combined with experimenter provided headings produced increased comprehension.
Concept vs. Semantic Maps	Beissner, Jonassen, & Grabowski (1993)	Learner-generated concept maps better strategy for holists. Learner-generated semantic maps better strategy for serialists for problem-solving learning only.
Concept maps	Smith & Dwyer (1995)	Learners using instructor-provided concept maps performed better on identification tests only.
Imaging	Bull & Wittrock (1973)	Recall was significantly higher for imaging than verbal/copying strategy. (having students draw pictures improved recall)
Elaboration	DiVesta & Peverley (1984)	Students who generated their own examples did significantly better on far-transfer tasks than those given instructor-provided examples.
Summaries and Analogies	Wittrock & Alesandrini (1990)	Summaries facilitated reading comprehension better than analogies, both did better than reading alone.
Generative teaching training	Kourilsky (1993)	Pre- to posttest gains on both exams were significant when misconceptions were clarified and learning covered again.
Self-questioning, summarizing, and note taking	King (1992)	Immediate: Summarizers performed better than self-questioners, who performed better than note takers. Delayed: Self-questioners performed better than summarizers, who performed better than note takers.
Instruction on summary writing versus reflection writing (Metacognitive Strategy)	Friend (1999)	Instruction on how to write effective summaries was more effective.

Vary the Format. Learners need to break out of the routine as much as anybody. Even efficient learners (like our students) benefit from a change of pace. Keller (2009) calls this changing of pace ‘variability’ and showed that it is needed to maintain an energized learning environment. Here are some clicker tactics that can help vary the format:

- The simple act of inserting a clicker question in a lecture changes the format in a refreshing way. The student can sit up, take notice, and construct an answer. When possible or practical, make the question an applied question that brings the taught information into a clinical setting.
- This is a great opportunity to present a context for the learning. Present a real-world vignette and have the learners apply what they have been learning in an applied context.
- Ask an opinion question with no real correct answer—and is yet relevant to the study—and have students choose courses of action. Then, with their answers on the projection, have them support their proposed action in a light debate format. This helps the students build a clinical problem solving process.
- Present a vignette with a sub-optimal but plausible solution. Have students choose why they either support or don’t support the solution. (e.g. give the vignette and solution, then for the multiple choice question, offer five reasons why one could support or not support it)
- Our *Turning Point* software allows for the designation of teams. You can divide the group into 4-8 teams, and then have them compete for points.

Bring it All Together. Parrish (2009) demonstrated the efficacy of designing the closing part of the lecture in a way that brings everything together. Using their clickers, students could respond to series of 1-3 slides that summarize the point of the lecture. For example, one slide could ask, “The major point of this lecture was…” and provide five options. A second slide

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Don Robison

could ask, “My main take-away was...” and provide five options. You could have students discuss this question before they are presented with the answer options. And a third slide could ask, “In my practice, I expect to see this issue...” and provide five options that may refer to frequency or types of cases.

Twenty Ways to Make Lectures More Participatory

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Lectures play a vital role in teaching. There will always be a place for lectures in the curriculum -- to give technical material or factual information, to provide structure to material or an argument, to display a method or example of how one thinks in a given field, or even to inspire and motivate students to explore further. At the same time, it often enhances both your presentation of the material and students' learning when students are able to participate in some way. When students engage actively with material, they generally understand it better and remember it longer.

Asking for student participation highlights the distinction between faculty covering material and students learning it. Student participation often results in covering less material during a semester. Yet it also can mean that students learn more material than in a traditional lecture course, because they truly grasp the fundamentals and have more chances to clear up confusion. Large numbers of students in class does not preclude interaction. The following list of ways to open up lectures to student participation have been used in classes of up to 1200 students, as well as in smaller groups.

Note: If you decide to invite student participation in lectures, consider beginning with the very first lecture, when norms and expectations for class are being established. It is more difficult to engage students in a large lecture class later if they are accustomed to being silent. If you decide to ask students to participate in lectures later in the term, give a short introduction or explanation about your change in strategy.

Beginning the lecture (or course)

1. Begin the course or the lecture with a question or questions which help you to understand what students are thinking. "What are some of the differences between clinical medicine and public health?" "How do we interpret medical research findings? For example, the response rate for one regimen is 23% and another treatment showed a 40% response rate. How can we interpret these numbers? What other information would we want to know?" "What would be a feminist perspective on contraceptive research?" "What are some examples of marginalized populations?" "What image do you have of people who have HIV or AIDS?"
2. Begin the course or the lecture by posing a problem and eliciting several answers or solutions from the students. The lecture can then go on to explore and build on the suggestions that emerge from the discussion. For example: "When you think about the definition of epidemiology, what possible applications of this methodology come to mind?" "What are some underlying biological factors for poor health status?" "What are some reasons people may not have health insurance?"

3. An interesting way to introduce topics you will cover in a course and to find out students' assumptions is to ask students to jot down answers to some questions on their own and then combine answers in a small group. Examples from a pre-course survey: "--List up to 10 major environmental disasters. --Name up to 10 health disorders in which environmental agents are causative; list the 10 etiologic agents. --Identify up to 10 national (U.S. or other) environmental laws and the problems they address. --Identify the kinds of data needed to characterize an environmental health hazard. --List the steps in quantitative risk assessment. Which steps require both epidemiology and biostatistics."

Inviting participation

4. Create an atmosphere that encourages student participation by using a conversational tone and not criticizing student questions or comments in front of the class. Students take a risk when they talk; you need to deal tactfully with their contributions. Your body language -- whether you hold yourself in a stiff or relaxed manner -- also influences student participation. Consider moving closer to the students rather than speaking from behind the podium. Explain your reasons for varying the traditional lecture style. Students more willingly participate in class if they understand the rationale behind an approach that may be unfamiliar.

5. If you want students to talk, look at them. Some teachers call on students. (Some teachers never call on students -- this is a matter of strong personal preference.) Asking students to speak in class is easier to do if they use name cards or if you have learned their names. This will encourage them to use each others' names as well; people are more likely to talk when they know each other. Some students will be too shy to speak in a large group, at least at first. If speaking in class is the norm and everyone is expected to do it, you can call on everyone in good faith (perhaps calling on better prepared --and bolder--students first, and asking easier questions later of the quieter students).

6. Invite challenges to your ideas. This can lead to lively debates and shows that students are thinking and engaging with the material. Also, invite questions. You may have to help students new to a field know how to challenge or question. One way to do this is to present different points of view on any given topic, and then state why you believe a certain view best accounts for the evidence. (Decide whether you are comfortable with interruptions or whether you want to have a question time at the end.)

7. When a student asks a question, instead of answering yourself, ask for an answer from other members of the class. In a large group, always repeat a question or paraphrase a response before going on, so that all students can hear and understand (this is especially important when students in the class do not speak English as a native language).

Punctuating the lecture with questions

8. Ask questions throughout the lecture, so that the lecture becomes more of a conversation. Asking students to raise their hands (for example, "What is the direction of the data: increasing?

decreasing?") is easier than asking them to speak. Questions with surprising answers can engage students' interest (for example, "What is the probability that two people in this room have the same birthday?") Generally, questions are more evocative if you are not looking for one right answer. The most fruitful questions are thought-provoking and, often, counterintuitive. For example, when comparing health indicators of different countries, ask students to guess where the U.S. or their country of origin ranks. Discuss the link between socioeconomic status and health; ask students to predict changes over time. For example, "Do you think it has gotten better or worse in your country over the last twenty years?"

9. Pause in the lecture after making a major point. Show students a multiple-choice question based on the material you have been talking about. (Example: "If the incidence rate of tuberculosis (TB) increased due to an increase in immunocompromised AIDS patients, but the duration of tuberculosis infections remained the same, the prevalence of TB would a) increase, b) decrease, or c) not change.") Ask students to vote on the right answer, and then turn to their neighbors to persuade them of the answer within the space of two minutes (talking to a few people is easier than speaking up in a large group). When time is up, ask them to vote a second time. Usually far more students arrive at the correct answer when voting the second time.

10. If readings have been assigned for a class, refer to them so their purpose is clear. You may ask questions about the readings from time to time; individuals or groups might be asked ahead of time to prepare short presentations of their interpretations of the readings.

11. When using slides, maps, or handouts, ask students what they see before you tell them what you see. Use these devices to help students think about a problem as you introduce it. For example, show a map of where cases occurred during an epidemic. Ask the students, "As an investigator of the outbreak, what questions might you want to ask?" Show a table of data about a country (birth rate, death rate, population, per cent of population with heart disease, number of nurses per capita, money spent on health per capita, G.N.P., etc.) Ask, "What do these data tell us? Where would you begin to explore? What kinds of questions could we answer and how?"

Varying the format

12. To vary the traditional lecture format, ask students, by section, to make presentations, do role plays, illustrate a position dramatically, debate a point. Or, ask TAs to give short presentations on areas of their expertise. Then invite the whole class to discuss the points illustrated.

13. For debates in a large group, divide the room into two or four groups, assigning one role or position to each group. Have the groups caucus separately to develop their positions before the debate begins. For example, in discussing the positive and negative aspects of a policy approach or community health intervention, divide the room in half for split brainstorming sessions; one group focusing on the positive and the other focusing on the negative. If there is time, have the groups switch positions. Or use the format of public hearings, with one group representing those who have called the hearings, and other groups representing the different protagonists.

14. Use cases to exemplify the issues you want to convey, and conduct the class as a case discussion rather than as a lecture. Cases are particularly useful for practical, how-to teaching

situations; for problem-solving or showing how experts solve problems; for situations in which there are a number of right answers; for integrating and applying complex information. In public health, cases can demonstrate policy and management problems, stimulate discussion of various ethical issues in health care, or provide realistic examples of the application of theory and particular methodologies of health care practice.

15. Stop the lecture and ask students to write for one or two minutes in response to a particular question. Then ask them to discuss the question. The writing will give everyone a chance to think about and articulate a response, and may enable broader participation.

16. Let students go to the board to write the results of work in a small group. For example, in the first part of class ask for the strengths and weaknesses of an intervention study. Then divide the room into groups, each with the task of designing a better study with the same exposure and outcome. Groups can go to the board (preferable to asking one student at a time to be at the front of the room) and a spokesperson can present the group's ideas.

Closing the lecture

17. Allow time for questions at the end of lecture. Ask if there are any questions or if students would like to have a point clarified. If your schedule permits, come early to lecture or stay late to answer questions and engage in discussion with students. If you are available five or ten minutes before and after class, some students will talk with you more readily, and you will get to know them and their thoughts. If beginning early and ending late creates a conflict for other colleagues assigned to lecture in the same room, talk with students in the halls before and after class.

18. Use lectures to set up problems or propose study questions for discussion that students are expected to prepare for lab or section. End the lecture with a provocative question. Ask the TAs to begin lab with a discussion of that problem or issue.

19. At the end of your lecture, or at any other appropriate stopping point, give students a one-question "quiz," based on the material just covered in the class. Ask them to answer the question collectively. Leave the room so that they can discuss the question for ten or fifteen minutes. Then return and have them report their answer; discuss with them the reasons for their choice.

20. Do a one-minute paper at the end of class. In this exercise, students write down what they consider (a) the main point of the class and (b) the main question they still have as they leave. You can use some of these questions to begin the next lecture, or students can be asked to bring them to section or lab. One advantage of this technique is that students may listen more carefully and review their notes thoughtfully.

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