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INCORPORATING STUDENT RESPONSE SYSTEMS IN LARGE ENROLLMENT CLASSES

CONTRIBUTERS

The group of contributors to this document came together to as part of a Faculty Learning Community (FLC): "Active Learning for Large Enrollment Classes" developed in the Center for Teaching Excellence (CTE) at the University of Florida. The group met regularly from the beginning of the Fall 2019 semester through the Fall 2020 semester. This booklet was put together in November 2020.

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Student Response Systems (SRS) are no doubt growing in use at the higher education level, whether used during class for discussion and lecture or for evaluative purposes (as a quiz or survey). The medium by which the instructor presents a class the question or problem, the students' response, how the response is received, and how it is reviewed varies. Our intention was to evaluate the primary SRS providers, which currently comprise iClicker, Learning Catalytics, and Top Hat, at the University of Florida (UF) to provide an easy to access compare and contrast document for colleagues. With the recognitions that SRS have proven benefits for students and instructors, the emphasis in this document is to share the use of SRS within our own STEM courses, drawing on our own experiences in both online (i.e. due to COVID-19) and in-person classrooms to aid other instructors seeking to incorporate SRS in their classrooms.

The emphasis in this document is to share the use of SRS within our own STEM courses, drawing on our experiences in both online and in-person classrooms.

The University of Florida has established relationships and in-person classrooms set up with the required equipment (where necessary).

OVERVIEW

iClicker

Clickers are web, application, and physical remote control-based. Lifetime clickers are available, as are short-term subscriptions for the web and app formats Content may be presented with anything and content does not need to be imported. iClicker can be used synchronously and asynchronously (i.e. for student review or homework).

Top Hat

Top Hat is web and app-based, and is only available for purchase as a subscription, ranging from a few months to several years. Content may be presented through slides imported to the website or through the Top Hat extension widget running parallel with your presentation program. Top Hat has both synchronous and asynchronous capabilities.

Learning Catalytics

A program by Pearson Publishing, Learning Catalytics is web and app-based, and can be purchased in 6- and 12-month subscriptions. Content may be present synchronously or asynchronously.

Packages such as Mastering A&P by Pearson Publishing grant access to this SRS to students and instructors at no additional cost. There is a stand-alone pricing and version, too: purchasing the textbook or online lab packages is not required in order to use this SRS.

COMPARISON TABLE

	Student Response System		
	iClicker	Top Hat	Learning Catalytics
Device Input			
Computer	Web	x	x
Tablet	x	x	x
Phone	x	x	x
Remote control	x		
Operating System			
Windows	x	x	x
Apple	x	x	x
Linux			x
Customer Service			
Phone	x	x	x
E-Mail	x	x	x
Web	x	x	x
Question Types			
Multiple choice	x	x	x
Heat map (click on target)	x	x	x
Short answer	x	x	x
Multiple answer	x	x	x
Image upload		x	x
Likert scale			
Wordcloud		x	x
Essay		x	x
Matching		x	x
Sorting		x	
Ranking/Confidence		x	x
Calculations (numeric)	x	x	
Drawing (individual)		x	x
Drawing (composite)		x	x
Direction (arrow)			x
Data collection (i.e. SRS reports summary statistics)			x
Mathematical expressions (algebraic equivalents			x
Text highlighting			x
Priority (like ranking but no correct answer, results			x
Fill in the blank		x	
Presentation Tool			
Website	x	x	x
Standalone application	x	x	
Requires console	x		
Cost			
Device	$27.99		
Software	UF Lic.; *Reef* starts at $14.99/6 mo.	*Pro* starts at $30/4 mo.; $48/12 mo.	$12/6 mo.; $20/year; Lic. options
Campus coverage	UF Lic.		Lic. Available
Question Library or Textbook Network		x	x
Question Grading			
Participation	x	x	x
Correctness (partial or full)	x	x	x
Response Types			
Instructor-led	x	x	x
Group test		x	x
Self-paced	x	x	x
Self-test		x	x
GPS Enabling	x	x	

CLASSROOM USE EXAMPLES

Courses: STATISTICS – QMB 5304, QMB 6858 - Megan Mocko

Prior to COVID, I was using iClicker in the classroom and during remote teaching, I am still using iClicker during Zoom synchronous sessions.

Class Enrollment: I typically use student response systems in my graduate student classes which have between 40 – 70 students. However, I have used student response systems in large auditoriums with almost 300 students and in classes with as few as ten students.

Questions: I typically ask 2-3 questions each class period. I like to ask a warmup question, question in the middle of lecture and then a closing question at the end of class. I don't always have a warmup and closing question but having them regularly encourages students to be on time to class and stay until the end. Since I teach statistics, the numeric answer option is a great option for me. However, I also use the multiple-choice option for interpretation of results. On the first day of class, I use the hot spot option where I ask students to highlight where they consider home on a large map of the world. I also use the short answer option to get students to ask about their muddiest points in the lecture. I require that the students answer this question, but they can enter "None". However, most students respond with a muddiest point. Their muddiest point may be about the current material that was covered, an upcoming assessment or how the exam is structured.

Grading: I have each question worth one point. They get 50% for just responding and the other 50% for getting it correct. I encourage students to use their notes and to talk to each other about the question. During remote teaching, I send them to a breakout room with a list of possible iClicker questions to discuss. When they come back to the main room, I then pick one question that we use for classroom participation points and then we just discuss the rest. I want to encourage student to student interaction. I really want these questions to be an opportunity to learn and to collaborate – not a pop quiz. Most of the time the grading is automatically done by the system. However, I do have to hand grade short answer questions.

Favorite Feature: I really like that I can write a separate PowerPoint slide deck of questions to show the students during lecture. I do not have to upload my questions to the platform online or other software. When I ask the students questions in lecture

using iClicker, the question then gets stored for the students on the iClicker system. This feature allows the students to be able to review these questions later without me having to repost the questions in the LMS. Additionally, I like that the students do not know how many questions I am going to ask during a class period.

Courses: CHEMISTRY – CHM 2045, CHM 2046 – Martina Sumner

I have used multiple audience responses systems including Turning Technologies, Top Hat, and Learning Catalytics.

Top Hat is an easy to use online clicker system (windows and apple) that does not need its own device. A computer, tablet/ipad, or a smartphone can be used (an app or browser).

Prior to COVID, I was using Top Hat in the classroom. I commonly use Top Hat to keep students actively involved in the classroom. I often ask quick "understanding questions" to ensure that the students are grasping a new concept. After showing the students how to solve a complex problem I will ask them to solve a similar problem using Top Hat.

During COVID, I was using Top Hat as a homework assignment. The students watched the lecture and then answered the clicker questions presented during the lecture as a homework assignment. So Top Hat questions were easily assignable as homework.

Class enrollment: Large enrollment classes (> 300/class)

Questions: I typically ask anywhere from 2 to 8 questions per 50 min class period. The number of questions I ask depends on the material we are covering that day. Quick and easy ones are true/false or multiple choice. The more time-consuming questions are numeric entry. After I demonstrate how to solve a complex chemistry problem, I then check for the students understanding by giving them a similar problem to solve in class. They input the answer using Top Hat. Students are encouraged to work with other students. Graduate TAs and I walk around the lecture hall and ask leading questions to help stuck students.

Grading: My students must get the answer correct to earn up to 3 points for the day (no participation points are earned). At the end of the semester I drop several days in the Top Hat category to allow for students who were absent for any reason. Top Hat

can easily be synced to Canvas (eLearning); for 300 plus students it may take 10 minutes or more depending on how many items need to be synced.

Cost: The cost is about $20 per semester (Fall 2020 prices) for any class so can be used for multiple classes for $20.

Favorite Features:

1. Top Hat questions that were answered during lecture are assignable as review by a click of a button (so students have access to the questions and the correct answers).
2. If a regrade becomes necessary, it is easy for any type of question. Just correct the question and it automatically regrades (takes seconds).
3. Power point slides can easily be inserted and edited in Top Hat.

Cons:

1. Students do not have to be present in the classroom to answer questions. However, attendance can be taken at any time during the class period and only the students present will get the credit.
2. Programming questions is quick and easy except for having to use LaTeX for sub and superscripts (Greek, math, and miscellaneous symbols are easily accessible via a + sign).

Courses: BIOLOGY – BSC 2005, BSC 2010, BSC 2011 – Norman Douglas

Class Enrollment: Enrollment in our introductory biology courses is high, with 200-300+ students present in each lecture session. The team-taught majors courses, BSC2010 & BSC2011, typically enroll over 1000 students in the Fall and Spring semesters, and so lectures are given 3 times a day. During the pandemic shutdown, BSC2005, students in our non-majors course, were directed to take an online-only section, but BSC2010 and BSC2011 were converted to asynchronous recorded lectures, with online discussions in some sections that featured student learning assistants.

Questions: Instructors will typically give 1-5 questions a day, and different instructors have different styles. Some prefer to use the questions for quizzing, to hold students accountable for readings, etc. I tend to favor an approach whereby questions are used to keep students engaged during explanations of complex topics, thus students' answers inform the lecture in

real time. Perhaps additional clarification is needed, and I'm able to work another example. Often I choose to spend several minutes on a question, if it's helping students to overcome misconceptions.

Grading: I use a mix of questions that are graded for credit. Learning Catalytics has a slider for each question to control the ratio, and my default is to give each question 0.25 points for participation and 0.75 points for correctness. For some questions, I just count participation (e.g. participation in a survey, questions with no right answer, questions that are too challenging).

Favorite Feature: I like the different question modalities available across all platforms, which create the opportunity to do some interesting activities. For example, I've used LC to survey students' heights along with their parents, and with the help of a TA, produce a real-time calculation of the heritability of height. We often use the direction and drawing questions to force students to make predictions about biological scenarios. During the lockdown, I used the file-upload question to have students upload pictures of plants belonging to different groups that they could find where they lived- and I commented on their responses. It's a very flexible platform that enables the instructor to be creative.

Courses: PHYSIOLOGY – APK 4115, APK 2105c* – Diba Mani

Class Enrollment: Each section of Neuromuscular Aspects of Exercise (APK 4115) comprises 50 students. This course has been taught with Top Hat integration for at least three semesters: Fall 2019, Spring 2020, and Fall 2021. Fall 2019 comprised an all in-person classroom setting; Spring 2020 started in-person but turned to online due to introduction of the COVID-19 global pandemic; Fall 2020 comprised an all-virtual classroom setting, with both synchronous and asynchronous use of Top Hat.

Questions: I ask 2-10 questions per lecture topic, which range in about 30-90 slides each. Questions are primarily multiple choice and short answer. Heat maps are used a couple times/semester. When lectures are given in-person, questions are asked synchronously, with an opportunity to discuss in small groups. When lectures are distributed virtually, they are pre-recorded with set pauses throughout, enabling students to pause their lecture to answer Top Hat questions. In this scenario, students answer questions on their own. Attendance and one question/session is collected via Top Hat for synchronous ("live") lecture sessions in the online classroom.

Grading: All questions are for participation only. To maintain consistency, each question is worth 1 point. When I sync from the Top Hat gradebook to the Canvas gradebook, I normalize the grades to fit the grade value I've listed for Top Hat in my syllabus since the start of the semester. This way, I am not limited by a specific target number of questions I can or need to ask.

Favorite Feature: I appreciate the excellent customer service that Top Hat provides. I have a representative an e-mail away. There is prompt response and the opportunity to meet via video conferencing at my leisure. Given the same representative is assigned to your classroom throughout the semester, a familiarity is established, and the representative does not need to be reintroduced to you or your classroom setup.

*As Applied Human Physiology and Kinesiology (APK 2105c) incorporates a Pearson Publishing textbook and virtual labs through their Mastering A&P platform, access to Learning Catalytics is including in the course equipment package. We will be incorporating Learning Catalytics both synchronously and asynchronously during lab sections (comprising up to 27 students each) in Spring 2021.

CONSIDERATIONS

As you consider which Student Response System to incorporate into your classroom, we suggest evaluating a few key aspects to aid you in making the most appropriate choice:

- Will you need test banks for questions, or will you develop your own questions?
    - Top Hat and Learning Catalytics may offer relevant question banks.
- Are you looking to integrate your questions with the textbook?
    - Learning Catalytics does this the best (Pearson Publishing).
- How many students do you have?
    - Although all three SRS described in this document can target a range of large enrollment classes, our experiences suggest some may be better for "smaller" classes (i.e. 50 students). Top Hat, for example, also offers embedded lectures and virtual proctoring (Beta Testing).
- What type of questions do you plan to use?
    - Depending on your need for, say, heat maps, you may select Top Hat over iClicker. If you focus on multiple choice and do not want students to subscribe on a semester-long or annual basis, iClicker via remote control may be ideal.

Although this document evaluates iClicker, TopHat, and Learning Catalytics, there are many other systems, including those which are completely free but still allow for simple questions to enhance student engagement in the classroom.