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# Clickers at Northeastern University: Preliminary Report

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# Clickers at Northeastern University

**Preliminary Report, Submitted by Victoria Wallace, May 14, 2009**

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# I. Introduction

This report outlines the definition of Clickers, gives some examples of Clickers currently in use at NU and ends with survey results of faculty who have used or are currently using Clickers. This information should be used to share potential uses and determine pilot vendors based on faculty requirements for a University-wide Clicker initiative.

## What are Clickers?

Clickers, also known as classroom response systems, student response systems and audience response systems, have been around since the 1960s, initially as hard-wired systems, which were very expensive and rather inflexible. The systems have evolved to the current versions of wireless radio frequency systems (combination of hardware and software) and virtual clicker systems that are web-based and can be run from laptops or delivered to cell phones and PDAs without additional hardware. Many institutions have adopted clicker technology as a quick and easy way of engaging students, assessing understanding and increasing student success, particularly in lecture classes. Faculty can easily build a few question slides into their PowerPoint presentations (or other applications, depending on product), create questions on the fly, or even ask questions verbally and then give students a minute to click in their answers. When all students have responded, a graph is displayed that shows how the students answered. Based on this visual feedback, a faculty member can continue with the lesson or stop and go back over the most recent concept to foster better understanding. Clickers can also be used to take attendance, which can be especially valuable in large lecture classes.

The main goals for utilizing clicker technology with classes are to engage, assess and increase student success. Applications include:

- Actively engage students through practice or review questions, can be in the form of games played individually or in teams
- Conduct opinion surveys, provide visual representation of different perspectives
- Pretest/posttest pairs – Pretests measure students' entry knowledge of course topics and uncovers deficiencies; posttest measures mastery of course content. Provides visual feedback to students of how they compare to peers. Poll and re-poll in same session to measure gain in understanding
- Promote collaboration – put students in groups, have them discuss a question, come to consensus, record their answer as a group, compare group responses, have students discuss discrepancies
- Generate instant feedback on question, issue or calculation
- Increase communication – hear from every student in class on every question
- Capture formative and summative assessment – measure student preparation, understanding or satisfaction
- Gather research data

## II. Clickers at Northeastern University

When a working group discussed clickers a few years ago, IS concluded that the technology was too much in flux to choose one system to standardize on. Now the technology has improved and stabilized, and there is extensive research from various universities about implementing the systems effectively across campus as well as research about their effectiveness.

### Northeastern faculty using Clicker technology

A number of departments are actively using clickers at Northeastern; all of these trials have been devised and spearheaded by faculty and staff enthusiasts. Departments/Groups that have used or are currently using clickers at Northeastern include:

| *Name* | *Department* | *Current Vendor* | *Note Summary* |
|---|---|---|---|
| Veronica Godoy-Carter | Biology | None – was Turning Point See Notes. | Class of ~40 students. Used TP for two semesters last year. Stopped using in January 2009. Mac user and Office suite 2007 was installed. TP does not support this version of the software.<br><br>Had setup issues at first but once running, very satisfied. TP support was very good.<br><br>Concern: students forgetting clickers.<br><br>Interested in participating in pilot. |
| Leslie Day | Physical Therapy | eInstruction | Started with eInstruction because attached to textbook (infa-red ).Switched to Turning Point but was not happy with faculty costs and lacked advanced features. Back with eInstruction for the past year. Likes the extra features and different reports.<br><br>Concern: cost to faculty |
| Michael Gonyeau | Pharmacy | eInstruction CPS 4 years<br><br>Switched to Turning Technology Summer09 | Logistics with laptop use have been a problem. CPS support was not good and was not happy with cost structure. Required registration did not allow faculty to use extra pads for class or dry runs of materials. |

| Name | Department | Current Vendor | Note Summary |
|---|---|---|---|
| Jim Matthews | Pharmacy | eInstruction CPS 4-5 years<br><br>Switched to Turning Technology Summer09 | Using only for engagement at this point – no credit. Use in large classes. (100-160 students) Has seen increase in participation. Satisfied with eInstruction but there was room for improvement. |
| Margarita Divall | Pharmacy | eInstruction CPS 4-5 years<br><br>Switched to Turning Technology Summer09 | Overall, was unhappy with eInstruction. Clickers had to be registered by students with vendor. Also, upgrades were difficult to understand. Trying TP because clickers are less expenses. Some receivers allow smart phone technology. |
| Gerry Schumacher | Pharmacy | eInstruction | 2005-Summer 2008 used eInstruction. Stopped using due to technology issues/failures (20%), bookstore hassles, always had to bring laptop, setup complicated, etc. Probably will not use again. |
| Judith Barr | Pharmacy | eInstruction | Same experiences as Gerry, but would use Clickers again. |
| Sarah Young-Hong | Speech Language Pathology and Audiology | iClicker | First year using clickers. Use in small classes and large clinical case conferences. Also, requires all students to use clickers in the clinical case conferences.<br><br>Concern: high markups at the bookstore and making sure bookstore has enough clickers in stock for students. On one occasion, all clickers were purchased and there were none left for her class. |

## Additional Northeastern faculty interested in using Clicker technology

- b.ritchie@neu.edu
- Christine Oka/Library/NEU
- Daniel F Quinn/CAS/NEU
- Donald King/CAS/NEU
- Iris Berent/CAS/NEU
- Janna D Kucharski-Howard/Health Sciences/NEU
- Jennifer L Kirwin/Health Sciences/NEU
- Ki Young Suzie Byun/Health Sciences/NEU
- Liana J Pennington/CAS/NEU
- Maureen A Harris/Health Sciences/NEU

- Michael Feeney/IS/NEU
- Paul A DiMilla/CAS/NEU
- w.smith@neu.edu
- Patricia Kiladis/Health Sciences/NEU@NEU
- MarySusan Potts-Santone

For students, clickers provide a means to actively participate in class, particularly in large classes. For faculty, clickers provide an alternate method of engaging students and measuring student comprehension.

As mentioned previously, clicker use is underway in Pharmacy, Speech-Language Pathology & Audiology, and Biology. Their typical uses include:

- Informally quizzing reading assignments
- Assessing student knowledge and re-design day's lecture based on scores (i.e., 90% correct - delete that content from day's lecture)
- Grading
- Attendance
- Learning Games
- Comprehension via ratings scale (1-10, How well do you know this material?)

These can be categorized into three strategies:

- 'Early Discovery': clickers often are used to assess students' fundamental knowledge from pre-requisite coursework.
- 'Immediate Feedback': Most times clickers are used to assess comprehension or application of content just taught.
- 'Retention': clickers can be used as a tool for assessing information retention at subsequent classes.

It is important to note that while clickers can be used to engage students and measure comprehension, to be effective, clicker questions and activities must be developed in conjunction with specific curriculum goals. Piloting a clicker program with a small group can help uncover weaknesses in the product and training requirements for application and implementation before it is more widely implemented.

## Potential Use Scenarios (types of clicker uses)

The goals and priorities of a particular course will influence the design and implementation of clicker technology and the required capabilities of the system. The following descriptions represent potential scenarios for clicker uses in the classroom.

### *Early Discovery*

**Discussion Warm-Up/Class Icebreakers**

Posing questions, giving students time to think about it, submitting their answers via clickers, and then displaying the results can be an effective way to warm-up a class for a class-wide discussion. Faculty can assess students' fundamental knowledge from previous courses or class pre-work prior to beginning the day's lecture. Compared with the approach of responding to the first hand that is raised after a question is asked, this approach gives all students time to think about and commit to an answer, setting the stage for greater discussion participation and an accurate assessment of class knowledge on a particular topic.

### *Immediate Feedback*

**Attendance**

Clickers can be used to take attendance directly (e.g. asking students to respond to the question "Are you here today?") or indirectly by determining which students used their clickers during class. The later is most often used at Northeastern University today.

**Contingent Teaching**

Similarly, this can be applied in real-time. Since it can often be challenging for instructors to determine what students do and do not understand, instructors can use clickers to gauge student comprehension in real-time during class and modify their lesson plan accordingly. If the clicker data show that students understand a given topic, then the instructor can move on to the next one. If not, more time can be spent on the topic, perhaps involving more lecture, class discussion, or another clicker question.

**Peer Instruction**

The teacher poses a question to his or her students. The students ponder the question silently and transmit their individual answers using the clickers. The teacher checks the histogram of student responses. If significant numbers of students choose the wrong answer, the teacher instructs the students to discuss the question with their neighbor. After a few minutes of discussion, the students submit their answers again. This technique often (but not always!) results in more students choosing the correct answer as a result of the peer instruction phase of the activity. This is a fairly simple way to use clickers to engage a large number of students in discussions about course material. This approach can also set the stage for a class-wide discussion that more fully engages all students.

**Data Collection**
Data collection is something that has not been done regularly but is something that faculty have expressed interest in. Clickers can capture data on student responses and provide them with frequent indicators of both individual and class learning progress which include comparisons with peer groups, previous classes and demographic subgroups - to encourage positive effects of self-assessment and competition among students. Data can be divided into demographic categories to facilitate course revisions, to provide input to students on demographic positions, and to provide information for personnel research into critical topic areas.

**Student Presentations**
Clickers are not just for faculty facilitation. Some faculty have required students to use clickers for clinical case conferences, which include 80+ students. Students use clickers to maintain engagement and/or reinforce material during and after their presentation.

## *Retention*

**Measuring Comprehension**
In general, instructors can create questions to measure comprehension and determine what students already know or don't know. This includes:

- Review of topics presented in previous classes
- Review of material covered in the homework

In order to assess students' understanding of topics previously covered or material covered in the homework, begin the class lecture with a number of questions or scenarios for group work to gauge their level of understanding. If 90% get the answer correct, move on. If the numbers are lower, be prepared to review the topic before moving on.

**Assessment (Formative)**
Clickers can be used to pose questions to students and collect their answers for the purpose of providing real-time information about student learning to both the instructor and the students. Students can use this feedback to monitor their own learning, and instructors can use it to change how they manage class "on the fly" in response to student learning needs.

In order to give students the chance to monitor their grade, increase participation, and encourage student use, a points system can be implemented. For example, one faculty member provides points strictly for participation. To make it more valuable for the students, she gives full credit (1) if the student gets 67% or higher, half credit (.5) for below 67% and no credit (0) if the student is absent. These scores are 5 or 10% of their total grade. This type of grading system rewards students for any response but provides more points if students answer correctly. Therefore, students have an incentive to take the questions seriously. A secondary result: more students attend class.

**Assessment (Summative)**
Due to concerns of accuracy and cheating, most faculty at Northeastern University do not use clickers for graded quizzes or tests. However, clickers can be used for graded activities, such as multiple-choice quizzes or even tests.

**Final Exam Reviews**
Take it one step further: the top-25 students in points receive extra credit. During the last class of the semester, faculty can review for a final exam by having the top-25 students compete with each other to answer potential final exam questions using clickers. Reviewing in this manner engages the entire class and allows every student to learn.

### *Other techniques used at other Universities:*

**Repeated Questions**
In the peer instruction approach described above, students respond to a given question twice--once after thinking about their answer individually and again after discussing it with their neighbor. Some instructors ask the same question several times, with different activities in between rounds of voting designed to help students better answer the question. For instance, an instructor might have the students answer the question individually, then discuss it with their neighbor and respond, then participate in a class-wide discussion and respond, and then listen to a mini-lecture on the topic and respond. For particularly challenging questions, this can be an effective technique for helping students discover and explore course material.

**"Choose Your Own Adventure" Classes**
In this technique, an instructor poses a problem along with several possible approaches to solving it--perhaps approaches suggested by students during class. The instructor has the students vote on which approach to pursue first, then explores that approach with the students. Afterwards, the students vote on which approach to pursue next.

**Case Study in Biology/Genetics**
In this “clicker case,” students read about a murder committed in Wales, then learn about DNA structure and replication and how scientists have adapted these concepts to develop processes for use in forensic analysis. The students use this knowledge to identify possible suspects in the crime. The case study is presented in class via PowerPoint, with multiple-choice questions sprinkled throughout the “lecture.” Students are expected to answer the questions as they arise using their clickers. Many instructors allow students to consult with their neighbor before clicking in their answer. The entire approach encourages student participation even in the largest of classes. The use of clickers in combination with case studies is described in greater detail in the article “Clicker” Cases: Introducing Case Study Teaching Into Large Classrooms. PowerPoint Slides:
http://www.sciencecases.org/druid_dracula_clicker/prelude.asp

**Question-Driven Instruction**

This approach combines contingent teaching and peer instruction. Lesson plans consist entirely of clicker questions. Which questions are asked depends entirely on how students answer the questions. An instructor might come into class with a stack of clicker questions, with multiple questions on each topic. As students perform well on clicker questions, the instructor moves on to questions on new topics. As students perform poorly, the instructor asks further questions on the same topic. The instructor does not have a lesson plan in the traditional sense when using this approach. Instead, the course of the class is determined reactively to demonstrated student learning needs.

## III. Support for Clickers

There are considerable information technology, distribution, portability and financial implications and constraints that must be figured into a University-wide clicker implementation regardless of the vendor chosen.

Before such an initiative can be launched, requirements must be vetted. These include:

- Purchase costs (for faculty, department, student, etc.)
- Facility/classroom setup, standardization policy
- Bookstore relationships, etc. must be vetted.
- Instructional support for faculty
- Training

A number of departments would be involved including Information Services, Educational Technology Center, Center for Innovation and Excellence for Teaching and Learning (CIETL), NU Libraries, and the Provost's Office.

One of the primary questions is whether there will be a standard clicker for the university in much the same manner as Blackboard is the standard learning management tool. The questions that follow were asked of faculty to help define vendor requirements.

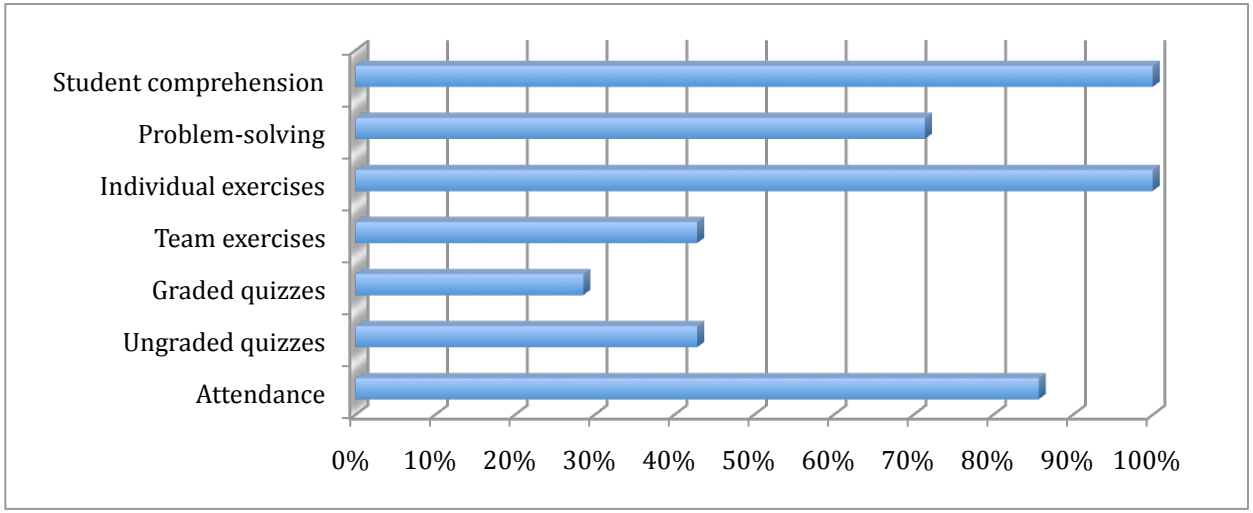
## IV. Interview Results

Nine faculty members participated in the interviews. In addition to questions asked for logistical and use case scenario documentation, the following questions were asked to help establish faculty requirements.

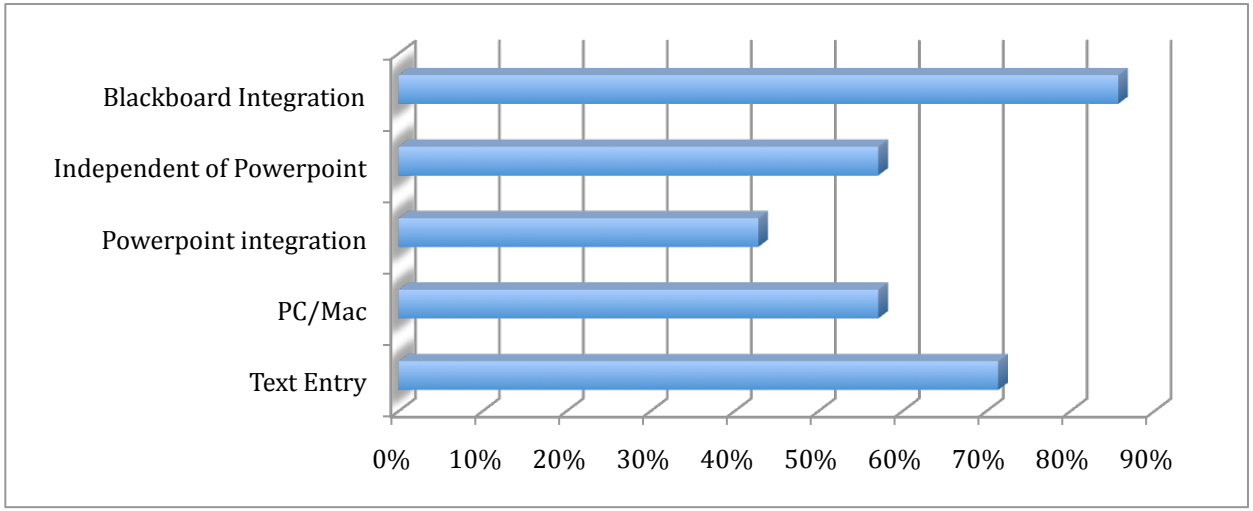
### Questions Considered:

- How much do the clickers cost?
- Is it a one-time purchase?
- Is there a registration fee per course?
- How easy is it to use?
- What is the relationship of the clicker system with textbook publishers?
- Does the clickers interface with LCD panels?
- Does the clicker have ext entry capability?
- Is the clicker dependent on or independent of PowerPoint?
- Is Student technical support included?
- Is Faculty technical support included?
- Is the Vendor's product on campus now?
- Does the product support both MAC and PC?
- Does the Vendor offer training?
- Does the product integrate with Blackboard?
- If using for quizzes and tests, how are grades transferred to Blackboard or other electronic grade book?

*I use clickers for:*



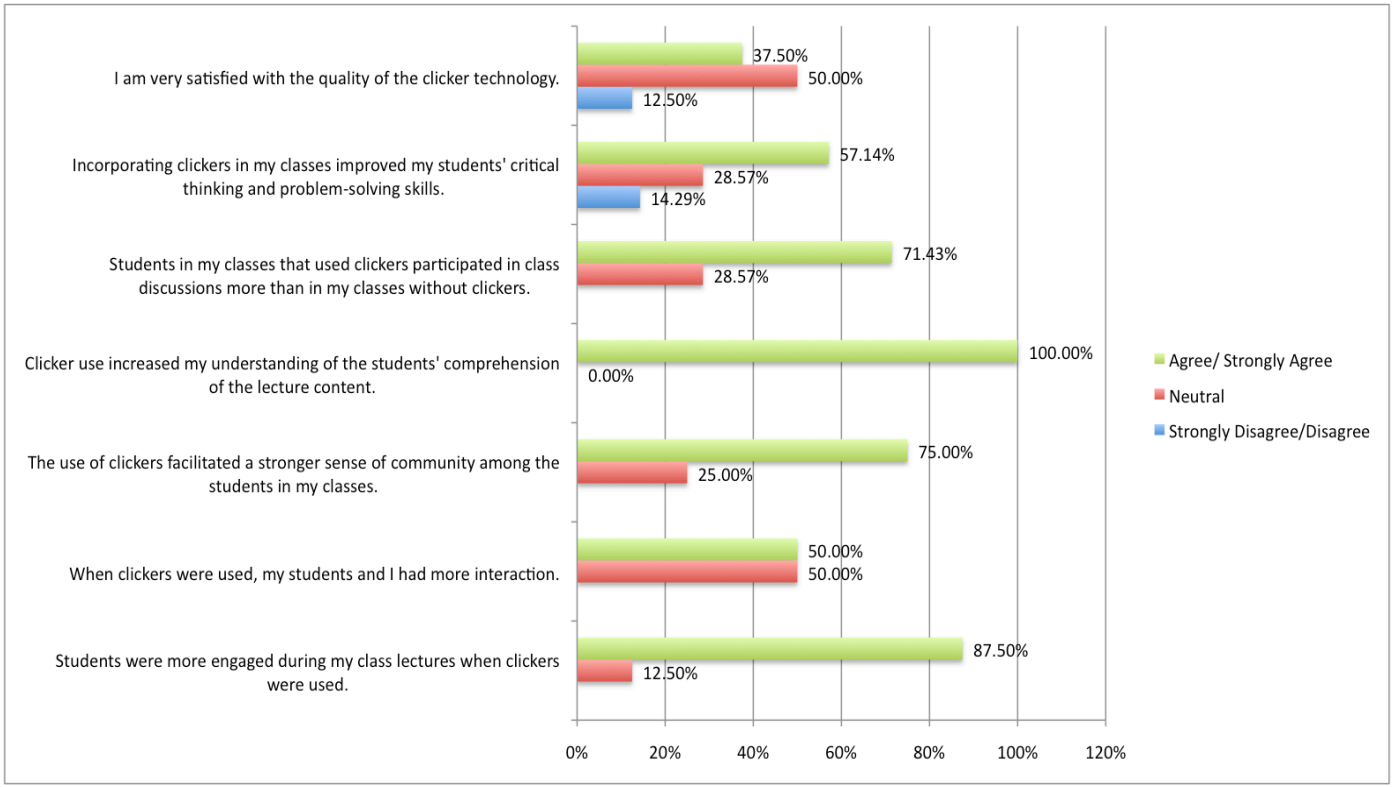
### *Features I am looking for or find most valuable:*




Additional Comments:

- Needs to work with both PC and Macs
- Needs to be easy to use without PowerPoint
- Needs to be both PowerPoint compatible and PowerPoint independent
- Should have automated scoring capability

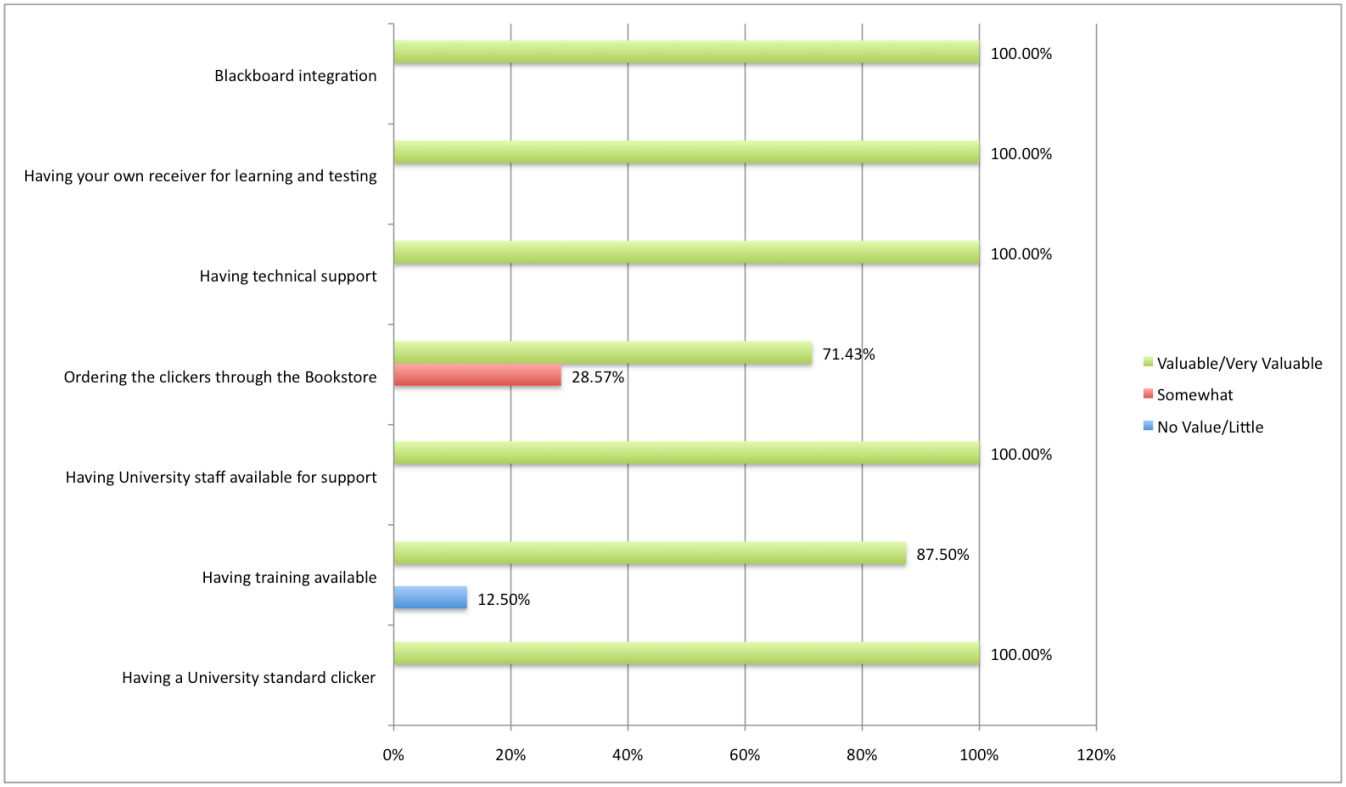
### *Rate your agreement with the following statements:*




Additional Comments:

- Even with clickers, still had to push students very hard to talk to one another.
- Clickers provide sense of community but can also use 'pair/share' technique to get same result.
- Only increased level of discussion among my Freshman class – probably due to anonymity – other classes already high level of discussion

### *In your opinion, how valuable would the following be:*




Additional Comments:

- Training is valuable from vendor but resource needs to be good/helpful.
- Ordering through bookstore is fine but would rather see University off as part of enrollment package so students do not 'see' a charge.
- Must support both Mac and PC
- Must work with PowerPoint and be able to work without it as well.
- University staff support is critical!
- Definitely need own receiver - - too much of a hassle to share with department when trying to learn product.
- Blackboard integration would be wonderful!

- Need great vendor support!
- Not happy with bookstore markup. Also, ordered 80 clickers for my department but another department forgot to order so all students were not able to purchase since students from the other class purchased from my order.
- Definitely need good training support at University.
- Need good technical support with vendor
- Receiver currently owned by department. Have to checkout. Would love own receiver for ease of use and would be more convenient.

## *Other Concerns/Considerations*

### Cost

- Lowest cost possible for student
- Bookstore markups too high
- Provost $ to buy Clickers for pilot?
- Vendor discounts since looking to standardize for entire university?

### Tech Support

- Setting up and dismantling can be time consuming. Need to make this easy.
- Need technical support.
- What standards are needed for clickers? What kinds of equipment will be required in the classroom?

### Pedagogy

- Instructors need to think about how and what kinds of questions to ask
- Need guidelines to use technology properly. Cannot use for just attendance. Need good student reaction by increasing class participation.
- Should also promote clickers as one part of an overall active learning strategy. They are not a panacea for active learning. Definitely good for some things, not so good for others.

### Policy

- Create fee and package with tuition ("Academic Services Fee")
- Need policy for defective clickers. Must be able to return to bookstore
- Need to market/highlight positive experiences (student and faculty) to create buy-in and adoption.
- Potential Issue: What about multi-section classes? If one instructor is using and others are not?

## V. Clicker Planning: Recommended process for implementing clickers at Northeastern University

### Charge

Assess clicker needs for the Northeastern community for both students and faculty. Review current University clicker initiatives and university priorities related to clickers. Identify pilot vendors for September '09 implementation. Based on evaluations of pilots, both students and faculty, make recommendations for broader implementation.

### Process/Timeline

1. Determine Goal
2. Form Committee/Task Force
3. Review background studies/examples from other institutions
4. Interview faculty who have/are using clicker technology
5. Collect requirements, use case scenarios - define use scenarios and feature requirements
6. Prepare background report on clickers (history at NEU, studies, examples of uses, etc.)
7. Identify tools based on requirements and recommendations - document
8. Host on-campus demo(s) of recommended product(s)
9. Review tools & select single product to pilot
10. Work with IS on integration requirements, work with Vice Provosts on funding model, integration model. Figure out how to market and encourage use
11. Create & distribute RFP, inviting people to participate in pilot
12. Based on RFP's, determine pilot participants; CIETL funds pilot
13. Solicit pilot feedback through surveys and focus groups
14. Evaluate pilot and make recommendations
15. Devise wider implementation strategy

# VI. Selected Resources

## Articles of Interest

In Search of Answers, Teachers Turn to Clickers: http://www.npr.org/templates/story/story.php?storyId=101343866

Best Ways for Professors to Use Student-Response Systems: http://chronicle.com/wiredcampus/article/3637/best-ways-for-professors-to-use-student-response-systems

Eric Mazur, Harvard University: http://www.columbia.edu/cu/gsapp/BT/RESEARCH/mazur.html
Numerous articles on Mazur site: http://mazur-www.harvard.edu/publications.php

"Writing the Book on Clickers"- Author of Teaching With Classroom Response Systems discusses the way a popular technology is changing instruction:
http://www.insidehighered.com/news/2009/02/24/bruff

A University of Wisconsin System Study by Robert Kaleta (kaleta@uwm.edu), Director of the Learning Technology
http://www.ctl.stanford.edu/PRS/Kaleta_Joosten_PRS_Wisconsin.pdf

7 things you should know about Clickers: http://www.educause.edu/ir/library/pdf/ELI7002.pdf

Ohio State University - Teaching Ideas: http://telr.osu.edu/clickers/teaching/ideas.htm

Designing questions for clickers (the levels of cognition):
http://telr.osu.edu/clickers/teaching/guidelines.htm

Going Beyond Classroom Clickers: http://chronicle.com/free/v55/i27/27a01301.htm?utm_source=at&utm_medium=en

Teaching and Learning with Interactive Student Response Systems: http://docs.google.com/Doc?id=dhkm7cbx_1jm355cgd&hl=en

Clickers Presentation at Educause:
http://connect.educause.edu/Library/Abstract/CombiningWebBasedMasteryQ/48369

Loyola University chooses iClicker: http://www.nmc.org/news/partner/loyola-university-chicago-selects-i-clicker-s-classroom-response-system

Boston.com 4/2/09: http://www.boston.com/news/local/massachusetts/articles/2009/04/02/clicking_with_students/

ACTIVE LEARNING fOR LG. CLASSES AT UNIV. OF MINN: http://www.classroom.umn.edu/active-learn-room.asp

http://its.sdsu.edu/wiki/clicker/index.php/Main_Page

http://itle.okstate.edu/index.php?option=com_content&task=view&id=130&Itemid=1

## Resources

Reports about clickers - http://srri.umass.edu/topics/crs/bibliography

Vendor links (reviews, etc) - www.blog.utoronto.ca/in_the_loop/files/ClickersERB0710.pdf

Article on successful clicker standardization: http://connect.educause.edu/Library/EDUCAUSE+Quarterly/SuccessfulClickerStandard/45543

Vendor: http://www.irespond.com/?gclid=CPPut5DLlpkCFQwNGgodk1dIag

Educause: http://connect.educause.edu/term_view/Classroom%2BResponse%2BSystems

COMPARISON MATRIX : http://itle.okstate.edu/index.php?option=com_content&task=view&id=128&Itemid=214

## Clicker Technology at other Universities

| *University* | *Department* | *Web address* | *Vendor Chosen* |
|---|---|---|---|
| University of Florida | Office of Academic Technology | http://www.at.ufl.edu/classrooms/crs.html | TurningPoint RCRF-01 clicker. |
| University of Kansas | Instructional Development and Support (IDS) | http://ids.ku.edu/content.php?layer=3&page=cmc&content=clickers | CPS system (eInstruction CPS) |
| Ohio State University | Technology Enhanced Learning & Research (TELR) | http://telr.osu.edu/clickers/ | Turning Technologies, LLC |
| University of Wisconsin-Milwaukee | Learning Technology Center (LTC) | http://www4.uwm.edu/ltc/srs/ | Turning Technologies, LLC |
| Cornell University | Academic Technology Centers | http://atc.cit.cornell.edu/course/polling/ | iClicker |
| University of Alberta | Information Technology | http://www.vpit.ualberta.ca/iclicker/ | iClicker |
| UMass Amherst | Center for Teaching | http://www.umass.edu/prs/ http://www.umass.edu/cft/resources.htm | PRS (eInstruction Interwrite PRS) |
| University of Colorado | Information Technology Services | http://www.colorado.edu/its/cuclickers/instructors/ | iClicker |
| Boston College | Educational Technology Services | http://idesweb.bc.edu/ides/website/teaching_tools/iclicker | iClicker |

| University | Department | Web address | Vendor Chosen |
|---|---|---|---|
| University of Minnesota | Office of Classroom Management | http://www.classroom.umn.edu/notes/support_srs.asp<br><br>Nov 2008: "…Before selecting a single SRS system for installation and use on a broad scale, the University must first address compatibility issues among the multiple vendors and units and the impact and issues involved in standardization of systems on campus. We are working toward that end. However, at this time, there have been no commitments made to install or support student response systems in central classrooms." | n/a |
| Providence College | Instructional Technology Development Program | http://itdp.providence.edu | Interwrite clickers (now under the umbrella of CPS) |

: