

What are the Benefits of the Use of Clickers in an AAS Electronics Technology Program?

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Introduction

Do clickers have benefits for an AAS Electronics Technology Program? This paper will analyze the following hypothesis regarding the benefits of clickers in such an application: 1) Clickers help improve the retention of material; 2) Clickers can increase student engagement; 3) Clickers can improve critical thinking when used appropriately; and 4) Clickers can promote self-directed and self-initiated learning.

Interwrite PRS RF clickers were used in this study

<http://www.einstruction.com/products/assessment/cps/index.html>.

The clicker system works as follows: 1) an instructor creates a question with the PRS software that appears on the classroom screen, 2) the students respond to the question via their clickers, 3) the statistics for the responses appear on the classroom screen, and 4) the instructor's computer receives a record of each individual student's response. The clicker itself looks similar to a remote control. The type of Interwrite PRS RF clicker questions used in this study included numeric questions, numeric questions with ranges, multiple choice, and true/false.

Hypothesis 1: Clickers help improve the retention of material

To analyze if clickers help improve the retention of material, I compared two sets of students through a series of 3 classes: Digital Electronics, Microprocessors I, and Microprocessors II. The group of students who did not use clickers (Group A) was enrolled in Digital Electronics in Summer of 2007, Microprocessors I in Fall of 2007, and Microprocessors II in Spring of 2008. The group of students who did use clickers (Group B) was enrolled in Digital Electronics in Summer of 2008, Microprocessors I in Fall of 2008, and Microprocessors II in Spring of 2009. These two groups of students were given an identical final exam for each of these 3 classes. Group A finished with 15 students and Group B finished with 16 students.

The group that used clickers had at least 3 clicker questions for every class period except for exam days. The averages for the final exam for these 3 classes for the two groups of students are shown in the Table 1 below:

Table 1: Averages on Final Exam for Group A & B for 3 Classes

Class Name	Digital Electronics	Microprocessors I	Microprocessors II
Group A (n =15) (no clickers)	82.93	80.93	81
Group B (n=16) (clickers)	85.33	85.33	83.87
advantage of clickers	2.4	4.4	2.87

As can be seen, Group B did better in all 3 classes: Digital Electronics, Microprocessors I, and Microprocessors II. The question should be raised if the class that used clickers (Group B) is more talented academically than the class did not use clickers(Group A). To answer this question these two groups of students were compared for a class (Electric Circuits II) where clickers were not used daily. In this case, the Group A had a final exam average of 81.58 and Group B had a final exam average of 80.47. Hence, the comparison of these two groups is valid; and as can be seen from the data the use of clickers daily in the classroom did improve the students' retention of data. These data matches are found by other researchers. For example, Morling, McAuliffe, Cohen, and DiLorenzo (2008) found that exam scores improved from .58% to 2.99% for groups that used clickers over groups that did not use clickers.

Hypothesis 2: Clickers can increase student engagement

To analyze if clickers can increase student engagement, a survey was given to the 16 students of a two hour UTC Physics II class(1 student came late so there are 15 students in one sample and 16 in the other). In this class clickers were used on a daily basis. During the first hour clickers were used to answer questions during a review session. During the second hour

clickers were not used to answer questions during a review session. The survey that was given is shown below:

	Not at all True			Somewhat True			Very True	
	1	2	3	4	5	6	7	
I paid attention to the presentation	1	2	3	4	5	6	7	
I was able to concentrate	1	2	3	4	5	6	7	
I was distracted	1	2	3	4	5	6	7	

The results of this survey are shown in the Tables 2, 3, & 4 below:

Table 2: Number of responses in each column without clickers

	#1	#2	#3	#4	#5	#6	#7
I paid attention to the presentation				1	1	3	11
I was able to concentrate				2	4	2	8
I was distracted	5	3	1	3	2	1	1

Table 3: Number of responses in each column with clickers

	#1	#2	#3	#4	#5	#6	#7
I paid attention to the presentation				1	1	3	10
I was able to concentrate			1	1	1	3	9
I was distracted	7	3		3		2	

Table 4: Averages of responses

	I paid attention to the presentation	I was able to concentrate	I was distracted
Average w/o clickers	6.5	6	3.06
Average w/ clickers	6.47	6.2	2.47
Advantage of clickers	-.03	+0.2	+0.59

As can be seen from the Table 4 above, there was almost no difference in the learners' perception of paying attention to the presentation with and without the clickers. There was a marginal difference between using clickers and not using clickers for their ability to concentrate and to avoid being distracted. With the question "I was distracted" reverse coded, the overall average without clickers was 5.81 and with clickers was 6.07 on a Lickert type 7 point scale. This shows a relative weak effect of clickers on student engagement. Carnaghan and Webb (2007) also found a relative weak effect of clickers on student engagement in their survey for accounting classes. However, by their general nature clickers increase student engagement since they require students to participate when their minds may be elsewhere.

Hypothesis 3: Clickers can improve critical thinking when used appropriately

To analyze if clickers can improve critical thinking, clicker questions were asked in the classroom that were geared towards critical thinking skills. For instance, in the Microprocessor II course sample programs with errors on them were put on the screen and students answered with their clickers which line number had the error. It was seen by the instructor that students improved on identifying errors in programs with this method. Specifically the first time this was tried in class the mean score was 2.29 out of 4 for the 14 students present in class that day, and the third time this was tried the mean score was 3.50 out of 4 for the 13 students in class that day. These types of questions are some of the best critical thinking questions that can be asked in a programming class short of having students write a program.

Hypothesis 4: Clickers can promote self-directed and self-initiated learning

To analyze if clickers can promote self-directed and self-initiated learning the following 3 questions were given via a web page:

1. The feedback from clickers in this class **really helped** me know what to study for this class.
2. The use of clickers in this course caused me to pay **less attention.**
3. The use of clickers in this course caused me to be **more motivated** to learn.

The choices were 1) not at all true, 2) a little true, 3) some true, 4) half true, 5) mostly true, 6) almost all true, and 7) very true. These questions were asked to a UTC Physics II class where clickers were used on a daily basis and 17 students were present (all of the students in the class). The results are shown in Table 5.

Table 5: Average and Number of Responses for Each Choice for the 3 Questions Asked

Question Asked	Average	#1	#2	#3	#4	#5	#6	#7
1. The feedback from clickers in this class <u>really helped</u> me know what to study for this class.	4.53	2	2	2		4	4	3
2. The use of clickers in this course caused me to pay <u>less attention.</u>	1.89	10	4	1	1			1
3. The use of clickers in this course caused me to be <u>more motivated</u> to learn.	3.59	5	1	3	1	2	4	1

From this survey it can be seen that the students found that clickers did help them to know what to study for this class and that the use of clickers did cause them to be more motivated. Similar results have been found by other researchers. Lincoln (2008) found through similar surveys that most students thought that clickers helped keep their attention. Cunningham (2008) found that "About 39 percent of the respondents said that the clickers made class more interesting, and some students commented in their course evaluations that they thought the clickers made time appear to pass quickly. A little over 43 percent thought they added no more interest to class."

Conclusions

From the research that was done it was found that all 4 hypotheses held some validity: 1) Clickers help improve the retention of material, 2) Clickers can increase student engagement, 3) Clickers can improve critical thinking when used appropriately, and 4) Clickers can promote self-directed and self-initiated learning. Clickers ability to increase student engagement appears to be the weakest of these hypotheses. As Kenwright 2009 states "Clicker technology is definitely worth trying since the monetary cost has dropped dramatically and some of the earlier problems have been eliminated with advances in technology." Specifically, the results of this research suggest that clickers are a worthwhile classroom tool for an AAS program in electronic engineering technology.

References

- Carnaghan, C., Webb, A. (2007) Investigating the Effects of Group Response Systems on Student Satisfaction, Learning, and Engagement in Accounting Education. *Issues in Accounting Education*, 22 (3), 391-409.
- Cunningham, B.(2008) Using Action Research to Improve Learning and the Classroom Learning Environment. *Issues in Accounting Education*, 23 (1), 1-30.
- Herreid, C. F. "Clicker" Cases: Introducing Case Study Teaching Into Large Classrooms. *Journal of College Science Teaching*,36 (2).
- Kenwright, K.(2009) Clickers in the Classroom. *TechTrends: Linking Research & Practice to Improve Learning*, 53 (1), 74-77.
- Lincoln, D. (2008) Teaching with Clickers in the Large-Size Principle of Marketing Class. *Marketing Education Review*, 18 (1), 39-45.
- MacGeorge, E., Homan, S., Dunning, J., Elmore, D., Bodie, G., Evans, E., Khichadia, S., Lichti, S., Feng, B., and Geddes, B.(2008) Student evaluation of audience response technology in large lecture classes. *Educational Technology Research & Development*, 56 (2), 125-145.

Morling, B., McAuliffe, M., Cohen, L., and DiLorenzo, T. (2008). Efficacy of Personal Response Systems ("Clickers") in Large, Introductory Psychology Classes. *Teaching of Psychology*, 35 (1), 45-50.