

**Report on the  
Classroom Performance System  
for use in the  
Navy Junior Reserve Officer Training Program**

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**21 July 2006**

## **1. Introduction:**

Most educators will agree that due in part to a change in cultural norms, high school students learn differently today than in the past. It is naïve of us to think that we will be able to change the way that these high school students learn, so we must explore different ways to effectively teach them.

**A. Why does the NJROTC need a polling system?** There are three principal issues that NJROTC must address for our curriculum to remain relevant for future cadets. First, we must move away from our lecture-and-listen teaching style. Today's educational research is full of discussions on the advantages of "student-centered learning" models. We have known for some time that lecture is not the best way to learn. The learning pyramid (enclosure (1)), which has been part of teacher education for decades, rates lecture as achieving only a 5% retention, while use of audio-visual, demonstrations and discussion groups achieve retention of 20%, 30% and 50% respectively. Second, we need classrooms that reflect today's technology and engage students in classroom discussions. We need a class model that invites students to participate and is the envy of the non-cadets in the school. This is one way to help our program recruiting efforts. Lastly, NJROTC instructors are provided only basic training in how to teach at the high school level and tend to revert to the method that they experienced in the military or in their own educational background, which is most likely lecture-and-listen. Our instructors need a model that will provide a template for successful high school teaching in a student-centered environment.

**B. Why look at CPS?** A large part of the overall answer may lie with the Classroom Performance System (CPS). Conclusions reached in a 2003 study of CPS at the Trident Training Facility (TTF) suggest that CPS would address the needs of our program listed above. Additionally, CPS has been successfully used at the United States Naval Academy, United States Military Academy, public schools throughout the country and, most importantly, since they are also teaching at the high school level, with Army JROTC. Therefore it made sense to look into how CPS may complement the NJROTC curriculum. A 2004 Department of the Navy Application Analysis conducted by the

Functional Area Manager (FAM) for Training and Education on portable/remote Polling Applications reviewed five of the most popular systems on the market and concluded:

“Based on the percentage of functional requirements and lack of substantial price differences, the FAM has determined that CLASSROOM PERFORMANCE SYSTEM (CPS) is the preferred application for the T&E Polling Application group....CPS is the preferred Navy application and must be used for all new acquisitions.”

Based on the current uses of CPS and the results of the FAM study CPS was a natural choice for helping NJROTC improve its curriculum model and meet its requirements.

## **2. CPS Description:**

The Classroom Performance System (CPS) by *eInstruction* is an educational tool designed to enhance interaction between students and teachers, and encourage students to participate in their own learning. It consists of an infrared remote control device called a response pad, CPS software, and an infrared receiver. The teacher uses his/her own questions, either in writing or via audio-visual inputs, projected on a large screen display and cadets respond anonymously via their assigned response pad. The computer instantaneously tabulates the percentage of correct/incorrect responses and frequency distribution. Instructors can use this information to monitor class understanding of the material. It promotes questioning and checks cadets' understanding of the material. “Checking for understanding” is one of the most fundamental of teaching processes but one of the most often overlooked, and is a key to achieving factors that promote learning. The response information is stored so the teacher can review individual responses at a later time to see who may be having difficulty with the material and adjust teaching techniques accordingly.

Cadets can also take their tests using CPS. CPS will grade the tests and input the grades directly into an electronic grade book provided with the software. This has the potential to save instructors hours of time normally spent grading and recording grades for cadet quizzes and tests. The CPS software can turn the results of the test into 20+ different

reports appropriate for parents, evaluation of test item validity, and assessment of class performance as a whole. There is significant potential for time savings once instructors become adept at using the system.

To determine the applicability of CPS to the NJROTC classroom the NJROTC program office conducted a small scale study using NJROTC instructors and cadets. Leveraging on the detailed study already completed by the TTF, we examined whether gains in test scores, student participation and teaching methodology would easily translate to the NJROTC environment.

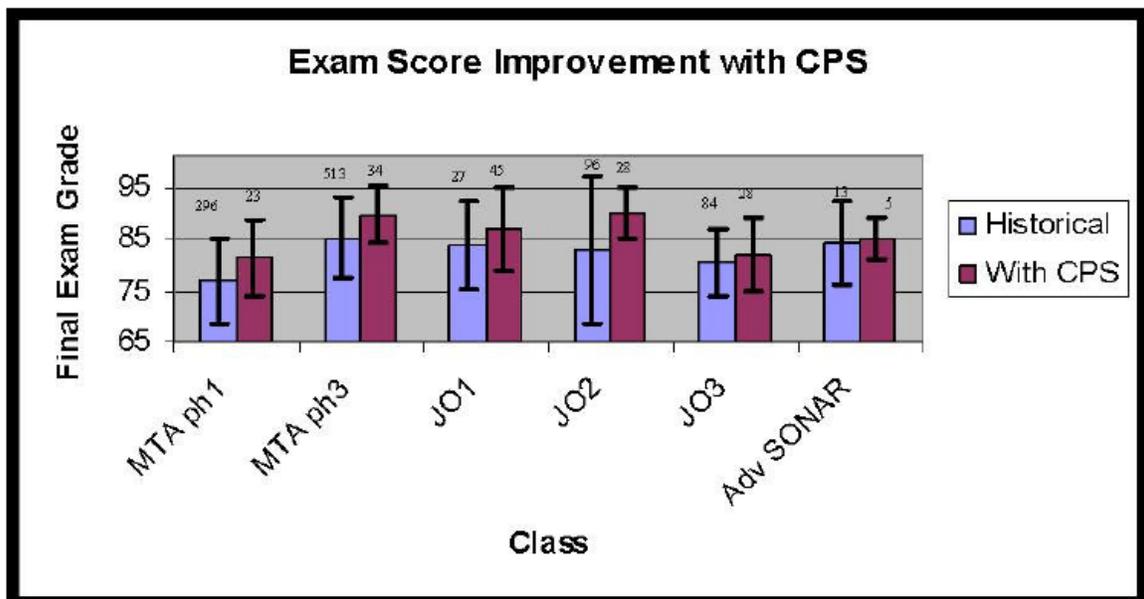
### **3. NJROTC Evaluation Plan Summary:**

To assess the applicability of the CPS system in the NJROTC classroom, a study was conducted with 13 NJROTC units. At no cost to the Navy *eInstruction*, supplied a 32 response pad CPS system to each participating unit. For the purposes of the evaluation, each participating unit was to teach a meteorology lesson from Naval Science 2 (Junior Year) using a prepackaged CPS style course of instruction that included CPS in-class questions, 4 quizzes and 1 end-of-unit exam. The same instructor was to teach all classes, CPS and non-CPS. The experimental class was taught using CPS delivery and test taking. Control classes were taught as they would normally be without CPS. All quizzes and the end-of-unit exam were the same in the experimental group as in the control group(s). In units large enough to have several classes the first class of the day was taught without CPS, the next class with CPS and if there were any additional classes they were taught without CPS. Therefore, a comparison could be made between CPS and include the additional classroom dynamics caused by daily routine or increased teacher familiarity with the material. NJROTC participating units had to complete the meteorology unit by the end of the spring semester of the 2005-2006 school year.

**4. Trident Training Facility (TTF) 3-year Study:** Capt Harkin and LCDR Brady completed an in-depth study in 2003 on the use of CPS at TTF. The results demonstrated significant increase in the same functional areas NJROTC identified as needing improvement. Therefore this study was a cornerstone for the NJROTC investigation and

NJROTC needed only to confirm that the findings in the TTF study would translate to an NJROTC classroom.

**A. TTF CPS/non-CPS grade comparison:** The TTF study compared final grades prior to CPS being used in the classroom to final grades after CPS was introduced to the classroom. The “without CPS” comparison used historical exam grades. Their findings, illustrated in figure 1 below, show a statistically significant increase in the final exam grades for each of the courses of instruction using CPS. The courses used in their evaluation were in Missile Technician Courses (MTA), Junior Officer Qualification Courses (JO) and Advanced Sonar.



**Figure 1. TTF Final Exam Grade comparison of historical and CPS classes (Harkins and Brady 2003).**

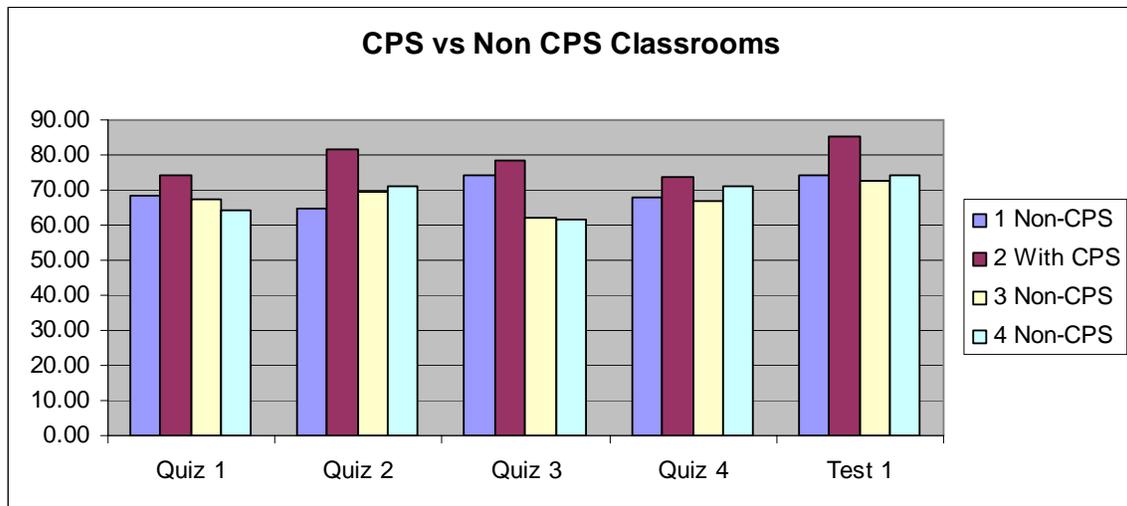
**B. TTF survey results:** The exam data was supplemented by survey data from instructors and students. The TTF student surveys demonstrated an “overall favorable impression” of CPS. TTF Instructors also had an overall favorable impression of CPS, but there was a concern that material could not be taught in the allotted time. The authors of the study felt this was because instructors were forced to spend more time checking for

student understanding and re-teaching those areas in which CPS indicated a lack of comprehension (Harkins and Brady 2003).

### 5. NJROTC Evaluation Quiz/Test Results:

The NJROTC evaluation was slightly different than the TTF evaluation in that it compared data between non-CPS and CPS classrooms taken at the same time vice using historical data. This was done because of the lack of historical data and the inherent inconsistency in testing between units spread over a broad geographic area.

Another difference between the TTF study and the NJROTC study was that the TTF study compared only final exams while the NJROTC study compared 4 quiz score averages and one end-of-unit exam average between non-CPS classrooms and CPS classrooms. Figure 2 below illustrates the comparison of the quiz and test scores for the NJROTC study. As in the TTF study, CPS classes demonstrate an obvious consistent advantage over non-CPS classrooms.



**Figure 2: NJROTC exam comparison between non-CPS and CPS classrooms.**

### 6. NJROTC Survey Results:

The surveys used in NJROTC were derived from the surveys used in the TTF study and adapted for NJROTC cadets. The cadet survey was given only to the cadets in the CPS

classroom as non-CPS classrooms could not comment on the use of CPS. The survey was completed by 251 cadets and 12 instructors.

**A. NJROTC cadet surveys (Figure 3):** Questions 1, 2, 3, 4, 6 and 9 indicate a strong positive response by the cadets to the CPS system. Question 5 response indicates that cadets felt that the use of CPS was worth extra classroom time. Question 7 response indicates that cadets were not intimidated by the use of the system in the classroom. This could be in part because of their familiarity with technology. Question 8 response indicates that students like to participate in class using CPS. Overall, this survey illustrates a very strong positive response by cadets to the use of CPS in the classroom. This is supported by the final open ended question of the survey which asked if given the choice between a CPS classroom and a non-CPS classroom, which they would choose? Of the 227 total cadet responses to this question 91% or 207 said they would choose the CPS classroom.

	4.0	3.0	2.0	1.0
Questions	<b>Strongly Agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
1. I have enjoyed using CPS in the classroom.	<b>*3.44</b>			
2. CPS helped me learn the material taught in class.	<b>*3.21</b>			
3. CPS helped me pay closer attention to the ideas and concepts presented in class.	<b>*3.15</b>			
4. CPS helped me understand the material better because it showed me the mistakes I made.	<b>*3.19</b>			
5. Using CPS after a short lecture <b>wasted</b> time that could have been used for class.			<b>*1.76</b>	
6. I enjoyed getting <b>more involved</b> with the class using CPS.	<b>*3.20</b>			

7. CPS made me <b>uneasy</b> because I had to participate whether I wanted to or not.			<b>*1.65</b>	
8. I do NOT like the wireless system, because I do NOT like to participate in class.			<b>*1.37</b>	
9. CPS <b>helped</b> me check my understanding of the material.	<b>*3.28</b>			

**Figure 3: Average scores for NJROTC cadet survey results.**

The general comparison between the TTF student survey and the NJROTC cadet survey suggests the cadets have a more favorable impression of CPS than the students in the TTF study. This may be due to the short duration and uniqueness of CPS to the cadets while the TTF students worked with CPS in more classes and over a longer period of time. Therefore, we could infer that a student survey taken after a longer period of use may dip somewhat but would remain positive.

**B. NJROTC instructor surveys (Figure 4):** The strong positive responses to questions 1, 2, 3, 4, 9, 10, 11, and 12 indicate a favorable disposition toward CPS and support the idea that CPS helped the instructors teach, and cadets learn the material. The less strong responses in questions 5, 8, and 10 indicate some reservations about using the CPS system. It appears from the comments discussed in the following paragraphs that their reservations center on the concern of additional time requirements that may be incurred when using CPS. There is an interesting dichotomy between cadet question 5, where the cadets *disagree* with the statement that class time was wasted using CPS and instructor question 5, where the instructors *agreed* with a similar statement. A similar situation was encountered in the Harkins and Brady study. In that study, it was hypothesized that without CPS, instructors would “plow” through material without taking time for questioning and discussion. With CPS, more time may be required to prepare questions and participate in discussions, and more class time may be required to ensure that the material was understood, therefore less material could be covered in a given class time.

However, the material that is covered would be better understood by the students, resulting in more productive classroom time as indicated by the higher test scores.

	4.0	3.0	2.0	1..0
Questions	<b>Strongly Agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
1. I have enjoyed teaching using CPS in the classroom.	<b>*3.58</b>			
2. CPS helped me teach the material presented in the lecture.	<b>*3.33</b>			
3. CPS helped cadets pay closer attention to the ideas and concepts presented in class.	<b>*3.25</b>			
4. CPS helped increase understanding by involving lecture participants in more active learning.		<b>*2.93</b>		
5. Using CPS after a short lecture <b>wasted</b> time that I could have been productively devoted to lecture.		<b>*2.44</b>		
6. I enjoyed the increased lecture involvement CPS provided cadets.	<b>*3.40</b>			
7. While using CPS classroom lecture time was used more productively and the material could be covered in the same allocated time. .		<b>*2.92</b>		
8. CPS assisted me to complete all learning points within the allocated time and in some cases the number of learning points was increased.		<b>*3.00</b>		
9. CPS <b>helped</b> me to quickly check for cadet understanding of basic points and clarify points which student missed after a short lecture.	<b>*3.67</b>			
10. Thought provoking questions stimulated the cadet's desire to seek self discovery and provided them		<b>*3.00</b>		

with the opportunity to compare their answers to those of the rest of the class. The subsequent discussions explored issues at greater depth and encouraged participation from a much larger percentage of the class.				
11. The use of interactive engagement strategies such as CPS can increase course effectiveness well beyond that obtained by traditional methods.	<b>*3.50</b>			
12. I would recommend that CPS be used in all NJROTC classrooms.	<b>*3.67</b>			

**Figure 4: Average scores for NJROTC instructor survey.**

**C. NJROTC instructor survey comments:** In addition to the scaled survey the instructors were asked to answer several questions concerning their experience. Their responses are summarized below under the questions.

**(1) Does the wireless system have the potential to save the classroom teacher time and effort?** This was one of the most significant concerns of the instructors. Eleven of the twelve instructors agreed that CPS will eventually be a time saver – but they had several reservations. The first concern is the amount of time spent on familiarization of the program and how to operate it within the classroom. One instructor recognized that there was a “steep learning curve on preparing for class.” Another instructor agreed by saying that “if lessons and evaluation tools are created prior to delivery, the time savings will be significant.”

All of the instructors were impressed with how quickly CPS graded exams and how this immediate feedback of student performance was a catalyst in overall classroom success. One teacher observed:

“...automatic grading of the quizzes and tests combined with instantaneous feedback to students provides instructors with more time to answer questions FOLLOWING an exam, while the system does the grading grunt work and provides detailed study guides to the student.”

Another instructor commented positively, saying that “overall it made me a better teacher as I got almost immediate feedback.”

The few teachers that complained about time being an issue pointed out that they “see a problem with having to spend additional time out of the classroom with each revision of the curriculum. “

**(2) Do you think you could use CPS without any additional curriculum items? In other words, if you had NOT been given the CPS meteorology disc, could you have used CPS and still been effective?** The issue surrounding whether or not CPS is capable of being added to the curriculum without additional curriculum materials goes back to the amount of work necessary to create the lessons. One teacher is concerned that in order for “CPS to be used to its maximum potential, instructors would require much greater training than we received.” This instructor also points out that “instructors who are less proficient with computers would probably give up in frustration and not use the system.” There are those who were successful at lesson creation and felt “...it would be cumbersome to alternate between instructional mediums, but having CPS would still allow for concept polling and testing thereby providing advantages.”

**(3) If you had a choice between updating a year of curriculum or purchasing CPS, what would you do?** All of the instructors agreed that CPS is a program worthy of purchasing and implementing into the classroom. Most of the responses concerning this question were similar to “buy CPS!” or “purchase CPS, definitely!” Others would purchase the system, but “only with (curriculum) discs (provided by headquarters)!”

## **7. Discussion:**

Army JROTC is spearheading the further development of CPS for the JROTC environment, including the creation of sophisticated games and standard CPS formats for questions that we can use in our curriculum to help instructors use CPS. NJROTC will be able to use, without development costs, those same games, formats and questions.

In order to assess the general feeling of more of the instructors throughout the country, CPS demonstrations were conducted during in-service training sessions for all eleven areas. The response was overwhelmingly positive with many instructors wanting immediate access to CPS. Others took CPS purchase information back to their schools to lobby the school to purchase the CPS system. However, similar concerns were expressed about the amount of time instructors would have to spend developing CPS-style lessons. Some instructors were adamantly against fielding the system without the curriculum being built around it.

Current funding levels will not support both routine annual curriculum reviews and the development of a new curriculum model using CPS. This is why the last question on the instructor survey concerning the priority use of resources between maintaining the current model and changing our curriculum model was asked. The answer was an enthusiastic “yes” that our resources should focus on CPS and moving toward a student centered learning model. The same response was received during in-service briefs. In order to provide the best possible product for the instructors and cadets, additional specific funding is required for CPS so curriculum reviews could continue during which lessons could be updated to include CPS related material in a student centered learning model. CPS appears to be the best way to improve the learning of the cadets as well as have a positive effect on the teaching methods used by our instructors. It gets NJROTC moving in the right direction immediately.

Regardless of whether NJROTC acquires CPS, a change must be made in the NJROTC’s curriculum model. Lecture-and-listen is not effective in a high school environment. We need to shift to a student-centered learning/active learning model. We need to make this change for two reasons. First, if we are going to teach the curriculum, then we want the

students to retain the material. Second, we want to attract more students via dynamic, contemporary, discussion-lead classes that use the latest technology. Lecturing teenagers is not an effective way to teach. It won't attract students to the program. The NJROTC curriculum office is reviewing how we may be able to adapt some of the other Services' student-centered learning curricula to our curriculum to save developmental costs.

## **8. Conclusions:**

A. The data in our study and in all other studies available to us demonstrate that CPS is effective in improving student performance.

B. The surveys support the adaptability of CPS to the NJROTC curriculum and show overwhelming positive support by cadets in the NJROTC program

C. Instructors support using the CPS system but are concerned that they will not get the curriculum support if and when they get the system.

D. Quality of instruction is improved when using CPS by forcing instructors to think more about questioning and discussion in the classroom. Additionally, it requires the instructors to periodically check for understanding, not just from one student, but from the class as a whole, and adjust the teaching methodologies accordingly

E. CPS is the first step in moving our curriculum away from lecture-and-listen toward a student-centered/active learner approach. It is the most important of many changes that need to be implemented since it changes the way in which we teach.

## **9. Recommendations:**

A. As soon as practical, using whatever resources are available, acquire CPS and CPS related equipment. This position is supported by the instructors who participated in the evaluation as well as the curriculum committee during their last meeting in February 06. The sooner we get the system to the instructors the sooner we will be able to learn CPS best practices and apply it to our curriculum.

B. Request funding from Naval Service Training Command to support our change to a student-centered learning/active approach.

(1) Provide funding for CPS thus freeing up funding to conduct the necessary curriculum revisions to include student-centered learning methodology into our curriculum. This would permit all NJROTC instructors, regardless of their proficiency with CPS, to use the system to a greater potential, as well as help save time for the instructors.

(2) As discussed above, CPS is the first step in overcoming the larger problem of curriculum model change. In the near future, NJROTC needs to leverage off Army JROTC educational research to make our curriculum more effective and more desirable to the general high school student body.

C. Since it is unlikely that we will be able to purchase CPS for everyone at one time, distribute CPS only to those instructors motivated to use this new technology. In this manner we will have motivated instructors establishing the lesson plans and models that can be used for all instructors at a later date. Our web portal has already been set up with a CPS lessons learned forum where instructors can share ideas and best practices.

## Learning Pyramid

The Learning Pyramid charts the average retention rate for various methods of teaching. These retention percentages represent the results of research conducted by National Training Laboratories in Bethel, Maine. According to the chart, lecture, the top of the pyramid, achieves an average retention rate of 5%. On the opposite end of the scale, the "teach others/immediate use" method achieves an average retention rate of 90%.



The Abilene Christian University Center for Teaching Excellence Adam's Center

<http://www.acu.edu/cte/activelearning/whyuseal2.htm>

Enclosure (1)