Report on the April 2013

New Jersey Center for Teaching and Learning

Training Mission

to

The Gambia

Ministry of Basic and Secondary Education

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Response to PSI-PMI by students and teachers

Participating students, in both Senior Secondary as well as Upper Basic schools, began learning PSI Algebra Based Physics and/or PMI Algebra I in mid to early January, 2013. By their spring break, at the end of March, students had had 10 to 12 weeks of instruction.

In 11 of the 13 participating schools, counting the Upper Basic School (UBS) and Senior Secondary School (SSS) of 22nd July as two different schools, though sharing one set of SMART equipment) the teachers have had working SMART Boards and SMART Responders throughout that time. In two of the schools, they are still awaiting installation of the boards, due to the need to first complete classroom renovations. Even in those two schools, the curriculum and, to a great extent, the pedagogy are being used.

In all cases, teachers made very positive reports about their experience teaching, and about student response to this method of learning. They report that students are now much more positive and engaged about math and science. Also, they report that students very much enjoy working in groups and the reduced amount of lecture.

It could be that this method of teaching and learning is even more aligned with the culture of the Gambia than it is with the culture of New Jersey, where PSI and PMI were developed. If so, this factor could lead to an impact that is larger even than the large effect seen in New Jersey. Of course, that impact could be mitigated by other factors.

> **Recommendation 1**: Qualitative research (in the form of student and teacher surveys, interviews and focus groups) should be done to determine if these anecdotal reports are correct. This finding would be very valuable to future work in The Gambia, and probably elsewhere, as to the effect of a different social structure on teaching and learning. This result would be an important outcome for this project, and have impact beyond PSI and PMI.

Assessments and Pretests

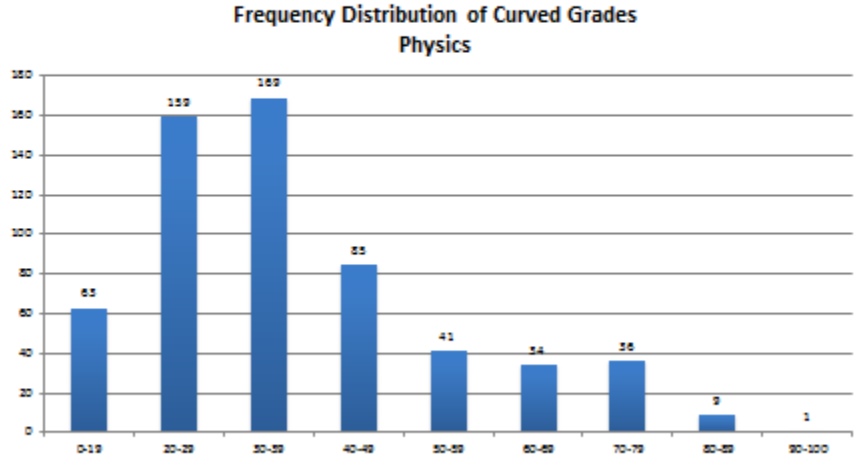
A pre-test was given to a large percentage of students in the project: 597 students in physics and 494 in mathematics. That pre-test was based on the first 40% of each course, as that was what was anticipated to be completed by the end of the academic year. The pre-test was graded by Peace Corps volunteers and the results were analyzed by Fatou Sey of MoBSE, and presented in a PowerPoint format.

The below two graphs, taken from Ms. Sey's report, provide a high level summary of the results of the student pre-tests. This represents the grade distribution, after the tests have been curved base on the assessment design.

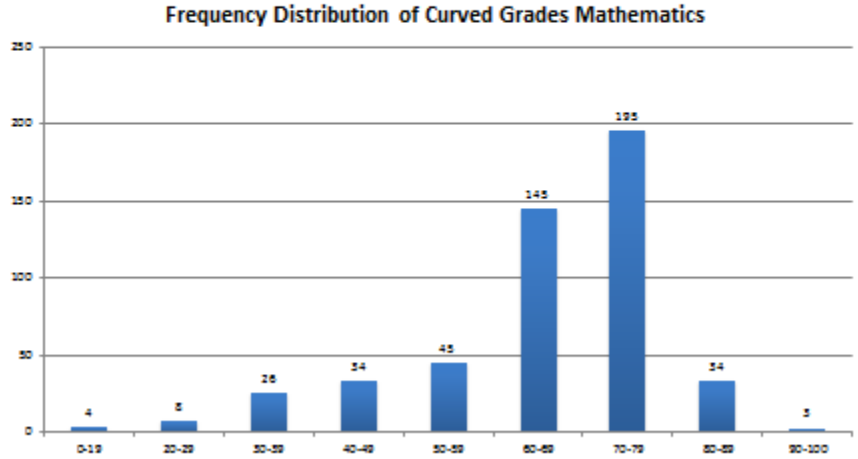
As expected, it is clear that students began the course with very little knowledge of physics. In fact, although probably not statistically significant, the UBS students scored slightly higher than the SSS students. The average curved grade of about 36% represents a "floor" value reflecting very little knowledge at the outset of the course.

On the other hand, students do possess knowledge of Algebra I, and Senior SSS students scored 7% higher on the math pre-test than did UBS students, reflecting an additional year of studying mathematics ((68% vs. 61%). This validates the idea that there was value in the additional year of mathematics study, but that there was no gain in physics from year to year reflects the lack of instruction in that subject.

Analysis of Pretest Assessment
Physics Pretest



Analysis of Pretest Assessment
Mathematics Pretest



Comparison of Means – Level
Physics

		Raw Scores		Curved Scores	
Level	No. of Students	Mean	SD	Mean	SD
SSS	292	13.6	8.8	35.8	15.1
UBS	305	15.29	10.1	39.2	18.1

Comparison of Means – Level
Mathematics

		Raw Scores		Curved Scores	
Level	No. of Students	Mean	SD	Mean	SD
SSS	275	32.0	12.6	67.6	13.3
UBS	219	25.5	11.0	60.6	14.6

As will be explained below, it now seems reasonable to complete about 25% of each course (PMI Algebra I and PSI Algebra Based Physics) this year. This is less than the 40% that was anticipated in the last report, and which was used to define the pre-test. As a result, we will need to consider that in comparing pre- and post-test results, but that will not be difficult.

Discussions with the West African Examinations Council (WAEC) has resulted in the planning of a workshop to be held in the coming weeks which will include MoBSE, PCV and participating teachers. The goal will be to write test items that align with the 50% of the GABECE that will assess student learning of the PSI-PMI curricula.

Curriculum, Assessment and Pedagogy

There have been 10 to 12 weeks of instruction in the 13 schools: from early January through March. That represents about ¼ of the academic year. Therefore, if all other factors were equal, students should have completed about ¼ of the courses they are taking.

However, it is to be expected that beginning a new program with new pedagogy and technology will require some start-up time. Given that, it is reasonable to expect that in the first ¼ of the first academic year the students would complete less than that, perhaps 1/5 to 1/6 of each course.

Further, the recent Peace Corps Volunteer (PCV) report updates the information on contact hours for these subject by school and indicates contact hours of between 120 and 160 minutes per week for both physics and for math (with at least one school adding time beyond the school day).

Based on that information, Gambian students have 60% to 80% of the New Jersey contact hours for math (200 minutes per week) and 55% to 75% of the time for physics (220 minutes per week). It's reasonable to estimate that that will allow the classes to cover about 60% to 70% of each course in a full year.

That would predict that students should have completed, or should complete:

- 10% to 12% of each course by now (1/5 x 6/10 = 6/50 = 12%)
- 13% to 16% by May 27: about five weeks from when school resumes
- 24% to 29% by July 22: when the school year ends

This is reduced from the estimate in the last report that students would complete about 40% of each course this year. This results in a series of recommendations:

Recommendation 2: The teachers should be surveyed to determine precisely where they are in each course in order to confirm whether the above analysis is correct, and can therefore be used as a foundation for planning. This would be a simple survey: asking for the last homework assignment given to students in each PSI-PMI classes. CTL would then use that data to compute the percentage of each course that had been completed as of the beginning of spring break.

Recommendation 3: The GABECE, to be given on May 27, should be based on the first 13% to 16% of each course. In physics, that would be Kinematics. In Algebra I that would be the first three units: Variables and Expressions; Solving Linear Equations; and Open Ended Application Problems.

Recommendation 4: By the end of the year students should have learned about 25% of each course. In addition to the above, they would have completed Dynamics in Physics and Graphing Equations in Algebra I. Based on that, we should assume that those students will be continuing from there at the start of the 2013-14 academic year.

Teacher Results for April Training Course

Four of the 18 participating teachers in the December 2012 physics course did not continue in the April 2013 training. However, they were replaced by two new teachers, so the total number in the class declined from 18 to 16. The results in the April class were very good with a mean of 95% and a median score of 96%. For the combined two training sessions the mean and median scores are both 93%. Considering that this is the same content used in the pre-test, where scores were very low, this represents meaningful learning on the part of the teachers.

Teacher Grades for Physics Course

		Combined Results To Date			April 2013 Training			December 2012 Training		
			660			400			260	
ID		Grade	Points	Missing	Grades %	Points	Missing	Grades	Points	Missing
1		92%	604	0	96%	386		84%	219	
2		87%	576	0	90%	361		83%	215	
3		99%	650	0	101%	403		95%	248	
4		95%	439	200	99%	198	200	93%	241	
5		98%	649	0	99%	398		97%	252	
6		85%	477	100	90%	270	100	80%	207	
7		96%	617	20	96%	385		97%	232	20
8										
9								87%	227	
10		96%	631	0	96%	384		95%	247	
11		87%	575	0	88%	354		85%	221	
12		92%	587	20	92%	369		91%	218	20
13		97%	637	0	97%	387		96%	250	
14		88%	403	200	94%	282	100	85%	121	100
15								95%	248	
16		93%	482	140	98%	393		88%	88	140
17								94%	243	
18								86%	223	
19		93%	523	100	96%	383		92%	140	100
20		88%	351	260	88%	351				260
21		96%	289	360	96%	289	100			260
	#	16			16			18		
	Mean	93%			95%			90%		
	Med.	93%			96%			92%		

One participant in the Algebra I course did not continue in April, but one more joined leaving the total number at 17. The grades also continued to be very strong in the Algebra I course, with a mean score for

the April training at 91% and a median scores of 93%. For the combined two training sessions the mean and median scores are both 90% and 91%.

Teacher Grades for Algebra I Course

	Combined Results To Date			April 2013 Training			December 2012 Training		
		971			484			487	
ID	Grade	Points	Missing	Grade	Points	Missing	Grade	Points	Missing
1	90%	853	20	92%	444		86%	409	20
2	96%	933	0	94%	456		100%	477	
3	86%	839	0	85%	413		90%	426	
4	95%	926	0	98%	477		95%	449	
5							100%	472	
6	88%	745	122	89%	430		67%	315	122
7	100%	968	0	100%	485		103%	483	
8	97%	938	0	99%	479		98%	459	
9	97%	942	0	95%	462		102%	480	
10	73%	604	145	59%	285		68%	319	145
11	88%	858	0	89%	433		91%	425	
12	91%	871	12	93%	449		91%	422	12
13	96%	927	10	99%	481		96%	446	10
14	95%	927	0	96%	465		100%	462	
15	82%	781	22	90%	434		75%	347	22
16	98%	947	0	98%	476		102%	471	
17	88%	742	132	88%	424		69%	318	132
18	76%	368	487	76%	368				487
#	17			17			17		
Mean	90%			91%			90%		
Med.	91%			93%			95%		

Technology, Facilities & Lab Equipment

The classroom technology has been installed in 10 of the 12 school buildings in which PSI-PMI is being taught. For 2 of the 12 schools, further improvements were required in their facilities before boards could be installed. It is important that at least the required roof work for these facilities be completed before the rainy season.

The 12 additional schools, which are joining the project in August, will need the technology installed as well, which may also require renovations. That requires identifying those schools quickly so that any needed repairs can be done quickly.

This will also require identifying a faster and less expensive procedure to acquire the SMART equipment and laptops so that they can be in The Gambia by the end of this school year, giving time to have them installed and working by the beginning of the next.

A key question which remains open is the procurement of round tables and chairs. While some schools have tried to solve this by using rectangular tables, the best solution remains to use five foot diameter round tables, without legs around the perimeter, so that students can flexibly move around the table to work in fluid grouping. Procuring these tables is still not resolved.

A plan to distribute physics lab equipment to the schools was made in December, 2013. This was not discussed further on this trip, however, that will be done by email with MoBSE, PCV and the teachers.

It has been challenging to figure out how to divide the equipment between schools as it is too expensive to get one set per school, and the logistics of sharing are complicated. CTL will review the equipment list to determine if it is possible to generate a new equipment list that will lower the cost per school and thereby provide one set of lab equipment for each of the new schools, and stay within budget. This will involve some compromises, but that will probably be better than the current solution which did not compromise on the breadth and cost of equipment, but compromised on quantities available.

Recommendations for next Phase of Implementation

Next year students who were in the program this year will need to continue their coursework based on where they end this year. This is true regardless if they were in 9th or 10th grade this year. That leads to the need for a mixed grade (grades 10 and 11) course which continues both courses.

Also, it now seems best to presume that UBS students, with their limited contact hours, would fare better with two years to learn these courses; beginning in 8th grade would be beneficial.

The below recommendations describe how this could be accomplished without increasing the cost for the training itself. However, work has to be done to the extent that additional technology will be required for a larger number of participating teachers, if those teachers can't share the PSI-PMI classroom.

It is also important to note that these recommendations represents a major step forward in building Gambian capacity, with CTL stepping back to a guiding role for the training of most of the teachers beginning in August, and maintain a lead role only in teaching SSS teachers new content. This capacity building within The Gambia is an essential objective of this project.

To avoid confusion with the four recommendations made earlier in the report, these recommendations for the next phase are numbered beginning with #5.

Recommendation 5: SSSs should offer at least one course for students in 10th or 11th grade who completed the first part of either PSI-PMI course this year. That course will have to be mixed by grade and 10th grade students will need to be identified as having been a PSI and/or PMI student when creating their schedule.

Recommendation 6: An evaluation should be done to see if additional SSS teachers need to be trained to accommodate students taking PSI and PMI courses in both 10th grade and 11th grade.

Recommendation 7: An evaluation should be done to see if additional SMART and other equipment is needed to set up an additional classroom to accommodate students taking PSI and PMI courses in both 10th grade and 11th grade.

Recommendation 8: 8th grade teachers in the current UBSs should be trained so that PSI and PMI can begin a year earlier. This will compensate for the lower number of contact hours by allowing both Algebra Based Physics and Algebra I to be taught over two years, and be completed before students enter SSS in the 2015-16 school year.

Recommendation 9: An evaluation should be done to see if additional SMART and other equipment is needed to set up an additional classroom to accommodate students taking PSI and PMI courses in both 8th grade and 9th grade.

Recommendation 10: In the new schools, in the new regions, teachers in grades 8, 9 and 10 should be trained so that the approach described above can begin in 2013-14.

Recommendation 11: An evaluation should be done to see if more SMART and other equipment is needed in the new UBSs than was originally planned, in order to set up an additional classroom to accommodate students taking PSI and PMI courses in both 8th grade and 9th grade.

Recommendation 12: Even though the number of teachers to be trained would be dramatically higher in August 2013 than has been the case, the number of CTL trainers should remain more or less constant. Most of the new training will be for the first half of Algebra Based Physics and Algebra I, so it should be done by the current UBS teachers with support from MoBSE, PCV and CTL. A goal of this project is to build the capacity within The Gambia. It will be especially valuable to have the current teachers instruct the new ones, since it will give them additional practice and confidence in their own teaching, and show the new teachers that they too can learn this content.

Recommendation 13: CTL personnel would be the primary instructors in teaching the current SSS teachers the second half of both courses. The SSS teachers will need to teach that to the Grade 10 and 11 students in their second year of PSI-PMI, and they will also then have the knowledge to teach the 9th grade UBS teachers by the time that they need that knowledge, when students come to them from the 8th grade PSI-PMI course.

Recommendation 14: A convenient location should be identified so that teachers from all regions can work together at one site. This will provide a critical mass of new and current teachers and allow MoBSE, CTL and PCV to interact efficiently with this larger group, even while they interact with one another. One idea would be to see if Gambia College has dorms which could be used to put up these teachers in August.

Recommendation 15: Gambia College physics and math instructors should join this new cohort to learn the methods and content of PSI-PMI. Teacher feedback indicates that that would be a great help to future math and science teachers in The Gambia, and would further build institutional capacity.