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Publication date

2012

Document Version

Final published version

Published in

Proceedings GIREP-EPEC Conference 2011

[Link to publication](#)

Citation for published version (APA):

van den Berg, E. (2012). Long term effects of an innovative physics teacher education program in the Philippines. In A. Lindell, A.-L. Kähkönen, & J. Viiri (Eds.), *Proceedings GIREP-EPEC Conference 2011: Physics Alive* (pp. 149-154). University of Jyväskylä.

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Long term effects of an innovative physics teacher education program in the Philippines

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In 1996 innovative, double major teacher education programs for Physics & Mathematics and Physics & Chemistry were initiated at the University of San Carlos in Cebu, Philippines. Both programs require 4 years of study. From the outset the focus was on making a difference in the *quality* of Science and Mathematics Teacher Education, producing teachers with a good mastery of subject matter and able to teach the subjects in exciting and effective ways in typical Philippine crowded and resource-poor classrooms. The programs recruit top high school graduates using a promotion and scholarship scheme and then expose them to the best science lecturers at the university, and create a special learning environment for the duration of their training. Early 2011 a study was conducted to assess long term effects of the programs through a tracer study of the 300 alumni, interviews, and 22 classroom visits to observe their teaching. Of the 300 alumni 245 are still teaching of whom 33 abroad (mainly USA) and 212 in the Philippines. Alumni are highly valued by principals of the top schools in Cebu and their students win many local and even national science competitions. Their teaching is competent with lots of interaction and good subject matter mastery, but they are also facing some typical Philippine education problems.

Introduction

Long term assessments of education projects and particularly international assistance projects are rare. Usually evaluation is limited to progress reports while the project is running and a final report at the end. However, I had an opportunity to return to a teacher education project 7 years after international assistance had ended. My assessment focused on alumni of the program. Where are they teaching? How do they teach? Is the program's "brand" of teaching visible? What problems do they face in the educational system in the Philippines?

The Philippines is an island archipelago with over 80 million people and a population growth of 2.4% per year. There are about 14 million students in elementary schools and 6.8 million students in the 4-year (grade 7-10) High School. The system has not been able to keep up with population growth. Many public schools in the Central Visayas region have over 60 students per class rather than the 40 common in other countries of Asia. Problems with educational quality are serious as documented in a Congressional Report (1993), TIMSS results (Balce et al., 2000) where the Philippines ranked 36th out of 38 on both the science and the mathematics tests, and the 2004 High School Readiness Test for elementary school leavers, where 50% of the students scored below 30% and were considered not ready for grade 7 (Olivares, 2004). Eighty percent of the chemistry teachers and ninety percent of the physics teachers are considered not qualified in these subjects (Ogena, 1993; Golla & de Guzman, 1998; Somerset et al, 1999a; Alcedo, 2002). These teachers majored in other subjects and were then asked or forced to teach physics or chemistry.

Typical classroom teaching: Somerset et al. (1999b) observed over 60 science and mathematics lessons in 15 public and private high schools in the Central Visayas. Most of these visits had been announced thus lessons were best prepared. Although they observed some outstanding lessons, most lessons were ineffective due to limited mastery of mathematics and science pedagogy. Alfafara and Dalman (Berg et

al., 1998) spent several weeks in two large public high schools. They observed over 60 lessons by 8 teachers. Most observation visits were unannounced thus assessing typical rather than best prepared teaching. Typical lessons consisted of the following: 1) checking attendance, 2) a 5-minute review of the previous lesson, 3) 20-30 minutes of note taking, 4) 20-30 minutes of teacher questions on the notes which usually could be answered by reading a sentence from the notes, 5) a short quiz with peer correction afterwards. Somerset (2002) tested 567 grade 8 and 10 students from 15 schools on basic arithmetic and metric estimation. He and his team also observed the teaching and concluded that most math lessons consisted of rules and drills without attention to concepts and contexts.

In response to the poor educational achievement, the shortage of physics and chemistry teachers and the poor quality of teaching the University of San Carlos (USC) in 1996 founded a 4-year Bachelor of Education pre-service teacher education program with a double major in either Physics/Chemistry or Physics/Mathematics with the following key features:

1. Selective admission of 30 students per year through a massive promotion, recruitment and selection campaign supported by scholarships (before there had been 1 or 2 physics, math, and chemistry teacher education students per year).
2. Emphasis on mastery of physics/math/chemistry and subject specific pedagogy suitable for resource poor classrooms with large classes (Berg, 1996).
3. Some special physics courses to make sure that teacher education students are exposed to “model” teaching in science. Other courses are taken together with science and engineering students.
4. Apart from rigorous emphasis on basic concepts, the program also promotes “fun” physics through discrepant events demonstrations (Liem, 1987), explanation of everyday phenomena (Hewitt, 1998), science exhibitions, science theatre (Berg, 2009), and science competitions.

For further details see Berg (2003), available from the author.

From 1996-2004 USC was one of 12 universities worldwide to receive large-scale institutional development funding from the Government of the Netherlands. Amongst others USC requested assistance from the Free University in Amsterdam for the development of its Science and Mathematics Teacher Education programs. USC was the only private university in the Dutch scheme and as such, although affected by the typical problems of SE Asian universities, it did have short decision lines making it possible to move quickly and dynamically in implementing the projects. The support included faculty and student scholarships, long term expert support for program and staff development and teaching, consultancies, and lab equipment. From 1996 – 2010 the program produced 300 teachers.

Research questions and methodology

The main research questions for the long-term evaluation were:

1. What happened to students (to be called alumni) who graduated from the 4-year teacher education program? Are they still teaching? Are they indeed achieving “top” positions in science teaching like work in more prestigious high schools and special science high schools?
2. Are the special features of science/math teaching in the pre-service program (high interaction, emphasis on concepts, motivation in fun science demo’s) still

- visible in the teaching of alumni? Or are they regressing to notorious teaching practices of Philippine schools (dictating, low intellectual involvement)?
3. What typical problems do alumni face in the Philippine education system and how do they cope?
 4. What is the influence of alumni on other teachers?

Data collection was guided by the research questions and comprised the following:

- School year 2010/11 placement and career data were obtained through e-mail, Facebook, and department records for 295 of the 300 alumni.
- Classroom observations of 22 alumni of different graduation batches in 8 different schools, 12 of these lessons were recorded on video;
- Questionnaire data from 58 alumni about their career path and details of their teaching assignment and other roles in the school;
- Interviews with 4 principals of schools employing alumni;
- Interviews with the current leadership of the teacher education program and of the supporting science/math departments;
- Additional data and insights obtained through many informal interactions during 7 weeks in Cebu in January and February 2011.

Results

Before presenting results of this study it should be pointed out that due to extensive promotion and the availability of scholarships the program was able to recruit exclusively among the top high school students. In each batch there were valedictorians and salutatorians and other honor students. This made for a unique student population. Students did enter with all the scars and gaps of a low quality high school education, but they had potential and it showed in comparison with other university programs and teacher education programs at other universities. Out of 300 graduates only one failed the national teacher licensure exam on the first trial while the national passing rate is only 25%. On the most recent exam of April 2011 one alumnus placed 3rd and another 8th out of 29,267 participants.

Research question 1: What happened to alumni of the program?

The data in table 1 show the placement of alumni who graduated between March 2000 (first batch) and March 2010 (eleventh batch) as of January 2011. A data base is kept by the secretary of the program Ms. Diana Honoridez and updated through personal contact with alumni, Facebook, Yahoo chats, e-mails, etc. The data were checked by the author through interviews with representatives of each batch and through e-mails and Facebook messages of alumni. As alumni keep in close touch with each other, it was relatively easy to obtain and verify the data. Out of 300 alumni, 245 (82%) are currently teaching and 53 + 2 (unknown) = 55 are employed outside teaching. Many of these are working in call centers, a major industry in Cebu, but there is also a practicing lawyer, a medical doctor as well as several science researchers and information technology specialists. That 82% are still in teaching is a good score and particularly the fact that 88% of those who graduated more than 6 years ago are still teaching (batches 2000-2005). In the USA it is estimated that 30% of beginning teachers leave the profession within 5 years (Guarino et al, 2006). Attrition tends to be higher for science and mathematics teachers than for other subjects. Unfortunately we do not have Philippine attrition data to compare with. Eleven percent of all alumni are teaching abroad, mainly in the USA, but there are some in Thailand, Korea, Japan, and Ireland. This matches the percentage of the

total Philippine work force working abroad. Of the early batches 2000 and 2001 about 30% are teaching abroad, mainly in school districts in the USA. That was not the intention but each of them taught at least 5 years in Philippine schools before their departure. Once abroad they often have a very hard first year as they are typically placed in difficult inner city schools, but they adapt and cope and some of them already made it to leadership roles as department chair in a science high school and member of a math test committee for a city in the Midwest.

Table 1 Placement of double major graduates during the school year 2010-2011

Batch	Total graduates	Teaching	Philippines private schools	Philippines public schools	Teaching abroad	Employed Outside teaching	Unknown
2000	32	31	10	10	11	1	0
2001	30	25	6	11	8	4	1
2002	26	23	3	11	9	3	0
2003	32	31	16	12	3	1	0
2004	26	21	10	9	2	5	0
2005	35	29	15	14	0	6	0
2006	19	16	12	4	0	2	1
2007	39	24	16	8	0	15	0
2008	16	13	2	11	0	3	0
2009	13	8	7	1	0	5	0
2010	32	24	23	1	0	8	0
Totals	300	245	120	92	33	53	2
Percent	100	81.7	40.0	30.7	11.0	17.7	0.7

Total number of graduates 2000 - 2010: 300

Careers: During a reunion 58 alumni filled in a questionnaire. Of those 46 had been teaching for more than 2 years. Of these 46, 11 were still teaching in their first school, 17 in their second, and 11 in their third. Those still teaching in their first school had been able to get into a well-run private school right after graduation. Many of those still in their second teaching job, obtained it one year after graduation when they could apply with their license and with experience and landed in a better school.

Research question 2: How are they teaching?

22 Lessons by alumni were observed in January and February of 2011. Twelve lessons were videotaped. In some schools video recording was not allowed. Extensive notes were taken on various aspects of the lessons in an open format rather than according to a fixed observation scheme, but with a time line. The classes of alumni were highly interactive, concept focused, with many demonstrations and associated meaning making and using examples from everyday life, thus quite different from the general Philippine pattern of lecturing, dictation, and low intellectual involvement. The setting was mostly traditional with the teacher up front explaining and asking many questions and students answering and doing various seatwork assignments. Subject mastery was good and was visible in the small number of mistakes and in the relevance and conceptual orientation of questions asked. Examples from everyday life were observed in all classes. Three alumni conducted lab sessions in classes of 18, 48 and over 50 students. Five others included brief lab activities in their lessons and another six conducted demonstrations. This is not common in Philippine schools and principals told me that this is a distinguishing characteristic of our alumni: they know their subject and use improvised equipment in

labs and demonstrations. Detailed observations and example lesson descriptions have been included in a longer version of the paper (available from the author).

Research question 3: What typical problems do alumni face in the Philippine education system and how do they cope?

Interview: two young female teachers are handling Physics and Chemistry at a rural public high school. They organize an annual science exhibition at their school just like they experienced in their teacher education program. Their main problem in teaching: in the afternoon quite a few students leave and do not come back. The teachers visited their parents, but parents let them.

This is a problem in more rural schools. Schools start sometime between 7.00 am and 8.00 am and run until 16.00 or 17.00 pm. That is a very long school day but nobody questions it. Many lessons in the Philippines (and elsewhere) are not very efficient with time. Nevertheless, for teachers this lack of motivation is a very serious problem, are they (teachers) wasting their effort?

In an elite high school which over the past 8 years has employed many science and mathematics alumni, I observed 2 good lessons and 2 outstanding lessons. However, I was surprised that in every lesson, the teacher collected an assignment from every student. Teaching 5 lessons a day with 40 students per class the teacher would have to check 200 assignments every day, leaving little time for preparation of the next lesson and turning the professional teacher into a slave. Furthermore, for the students the focus of a lesson might degenerate into a piece of paper. The teachers said they had to collect every single homework and seatwork assignment, otherwise it would not be done seriously in this elite school. My own explanation is that when they just started teaching the teachers had a hard time dealing with the unruly elite students. Then they needed the threat of assignments with grades in order to gain control. Now that they do have experience and control, they still believe that students will only work when threatened with assignments and grades and so both the teachers and students are now enslaved in a pattern.

After the classroom observations we discussed several alternatives to reduce the grading load but I do not yet know what has come of it. It should be emphasized that these are good teachers whom most principals would be happy to hire.

In Philippine high schools physics is frequently limited to mechanics, often because the teacher feels less confident in other topics, or because they want to offer the best preparation for the first university physics course. To my great disappointment I encountered this situation in two schools and it concerned alumni with outstanding subject matter mastery. In one of these schools this has now been corrected.

Research question 4: What is the influence of alumni on other teachers?

Alumni founded active science teachers associations on the islands of Cebu and Bohol where other science teachers also participate. Alumni have presented at national conferences. Students of alumni are very visible in regional and national finals of science competitions like the Intel competition. At half of the schools visited alumni were heading the science department and seemed to have good cooperation with other science teachers and are being consulted by them on matters of science knowledge and teaching methods. One alumnus is now principal of a new science high school. Of the alumni in the USA, two are now heading the science department in their schools and one is on a city wide mathematics assessment committee.

Conclusions

The alumni of the double major programs have made a good name for themselves. They are actively recruited by the top private schools and public science high schools and are appreciated by their principals. Over 80% remain in teaching 5 years after graduation. The lessons of alumni are competent, very interactive, and include demonstrations and frequent references to everyday science phenomena. With their large classes, their teaching is teacher-centered. Understandably their teaching is affected by some of the typical problems of the Philippine education system and some fall into traps of that system such as all the paper checking with elite students or teaching only mechanics. The alumni do play an important role in improving the quality of science and mathematics education in the region.

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