Abstract Title Page

Title: MOOCs Feasibility Study: Demand among Teachers in Rural Ghana

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Abstract Body

Background / Context:
Massive Open Online Courses (MOOCs) are a relatively new, low-cost resource that hold potential for improving learning in developing nations where resources are constrained and teacher expertise can be limited. However, little information currently exists about the effectiveness of leveraging MOOCs as a vehicle for teacher training. To design optimal teacher-targeted MOOC interventions, additional evidence is needed regarding the demand for and accessibility of MOOCs among teachers, as well as the barriers to effective implementation.

A foundational claim in the general schooling literature is that teachers matter for student learning (Sanders & Rivers, 1996; Rockoff, 2004; Rivkin, Hanushek and Kain, 2005; Boyd et al, 2006; Clotfelter et al., 2010). However, as Banerjee et al. (2013) highlight, finding well-trained teachers, particularly at the post-primary level, is likely to be more challenging in countries where fewer individuals complete post-secondary, much less secondary education. For instance, in Ghana, teacher training has been deemed as particularly inadequate, with many teachers not having completed shorter training programs, much less bachelor's degrees in teaching (World Bank, 1996; 2004; 2012).

While teacher training and knowledge may be limited in developing nations, innovative use of technology may hold promise for the improvement of teaching quality (Banerjee et al. 2007; He et al. 2007). Already, a number of MOOCs are being developed that target teachers and are aimed at improving pedagogy and instructional practices (Schwartz, 2013; Wilson, 2015). However, to our knowledge, little has been done to test their effectiveness as vehicles for teacher training and professional development delivery, particularly within developing nations.

Moreover, although MOOCs have been touted as a promising, low-cost solution for improved learning in developing countries, obstacles such as internet access, language, and computer literacy limit their potential (Liyanagunawardena, Williams & Adams, 2013). Thus, a crucial first step in understanding how MOOCs can fill gaps in teacher training is better information about the demand for and accessibility of MOOCs among teacher populations in more remote and under-resourced contexts.

Purpose / Objective / Research Question / Focus of Study:
The aim of this study is to learn more about the awareness, interest and ability to access MOOCs among junior high and high school teachers in rural Ghana. Specifically, I address the following questions:

1) What is the take-up following a light informational intervention nudging math teachers to enroll in a MOOC related to math education?
2) What is the demand among school leaders, specifically headmasters, for MOOCs as a vehicle for teacher training?
3) Can headmasters influence the decision of teachers to enroll in a MOOC course?
4) What are the reasons teachers do or do not enroll and/or complete a MOOC course?
5) How does take-up differ by teacher and headmaster characteristics?

Setting:
The current study builds on a larger randomized study examining the long-run returns to

secondary schooling in rural Ghana (Duflo, Kremer, and Dupas, ongoing), through which detailed student- and school-level data were collected at 242 junior and senior high schools in five districts in Southern Ghana (Ashanti, Brong-Ahafo, Central, Eastern, Greater Accra and Western). Evidence from the randomized study suggests that the students attending these schools are particularly weak in applied mathematics skills, important for success in post-secondary education and in the labor market.

The poor learning outcomes observed in these schools are not isolated to this sample of students and appear to be reflective of wider schooling in Ghana. In 2011, a report commissioned by the Ghanaian Office of the President raised questions about the quality of secondary schooling, attributing a troubling statistic that roughly 45 percent of students fail core subject tests in English, mathematics, and science to factors including weak school management and inadequately trained teachers (Anamuah-Mensah, 2011). In remote rural areas in Ghana, schools struggle to attract and retain professionally trained teachers due to a number of reasons including poor sanitation, inadequate transportation, and a lack of local amenities (World Bank, 2012). Pedagogical norms in Ghana have been characterized as didactic and placing primary emphasis on recall and rote memorization over critical thinking and problem solving (World Bank 1996). The inadequate training of teachers who teach in remote locations could be one important factor behind higher teacher absenteeism and prescriptive teaching methods observed in rural Ghanaian schools (Addy, 2008).

Population / Participants / Subjects:
To learn more about whether MOOCs could serve as a means to train teachers in this type of setting, mathematics teachers at the junior and senior high schools attended by students in the randomized study were recruited for participation in this study. The participants of the study include mathematics teachers (N=543) and headmasters (N=242) at the 242 schools (112 junior high schools and 174 senior high schools). Junior high schools typically employ 1-2 mathematics teachers, thus all were recruited for a total of 174 junior high teachers (1.55 teachers per school, on average). Senior high schools in the sample employ 9.5 mathematics teachers on average. Because of limited resources, 3 teachers were randomly sampled from math teacher rosters for a total of 369 senior high teachers (2.84 teacher per school, on average). The random sample of teachers reflects the demographic makeup of the larger sample of teachers in these rural senior high schools.

Intervention / Program / Practice:
When visiting the 242 schools as part of the larger randomized study, the research team provided the 543 senior and junior high mathematics teachers with information on how to enroll in a 10 week MOOC focused on mathematical thinking and the application of mathematical tools for problem solving. This was a very low-cost "light touch" intervention: Teachers were provided with the MOOC enrollment website and some basic information on the course roughly 3 months before the MOOC began. A reminder SMS was sent to teachers in the 2 weeks prior to the start of the course. No additional incentives (monetary or in-kind) were provided to teachers for their enrollment or completion of the course. The intervention was intentionally minimal and designed to capture demand for online teacher training given a simple, low-cost and easily scalable information campaign.

In a randomized subset of schools, school headmasters were also contacted 2 weeks prior to the start of the course. Headmasters received both a phone call and an email through which they

were provided basic information on the MOOC and asked to encourage teachers to enroll in the MOOC. At this time, headmasters were also able to ask the survey team about the MOOC and given the opportunity to voice concerns about teacher enrollment in the MOOC.

Research Design:

RQ1: What is the take-up following a light informational intervention nudging teachers to enroll in a MOOC related mathematics education? The first research question involves a simple comparison of the enrollment and completion rates among the teachers that were provided the informational nudge. Detailed click-stream data provided by the MOOC platform allows not just for the identification of those that enrolled in the course, but also the extent of their participation and engagement in the course, including the viewing of online videos, assignment completion and grades, and participation in the course forum.

RQ2-3: What is the demand among school leaders, specifically headmasters, for MOOCs as a vehicle for teacher training? Can headmasters influence the decision of teachers to enroll in a MOOC course? Because headmasters were randomly selected to receive informational nudges, take-up among teachers at schools with the headmaster treatment can be compared with those at schools where headmasters were not contacted. Greater take-up among teachers whose headmasters were contacted may reflect the demand among school leaders for teachers to utilize MOOCs as a means to improve instructional quality. Detailed follow-up survey data with these headmasters was also collected to help explain these results. In a follow-up phone survey, headmasters were asked whether they encouraged teachers to enroll and the steps they took to encourage teachers. Headmasters were also asked to explain why they did or did not decide to encourage teachers to enroll.

RQ4: What are the reasons teachers do or do not enroll and/or complete a MOOC course? A detailed follow-up survey was also administered to teachers in order to learn more about their decision whether to enroll and complete the course. This survey, roughly 20 minutes in length, is particularly important for illuminating findings from click-stream data and for understanding the drivers of demand among this sample of teachers. This survey also helps identify barriers for the use of MOOCs for teacher training. For instance, the survey asks teachers about their internet access and ability to access course materials, as well as what amount of time they have available for which they are willing to spend on course activities. Results can help reveal, for instance, whether low adoption rates are a result of limited internet access versus limited time and/or interest among teachers. The survey also inquires about the experience of teachers who did enroll in the course. Data from the follow-up survey will provide clues for how online course developers can structure courses in a way that best reaches similar populations of teachers in the future.

RQ5: How does take-up differ by teacher and headmasters characteristics? Because of extremely detailed survey data on teachers, headmasters and schools that were collected as part of the large randomized study, it is possible to examine how take-up differs across a host of characteristics. Heterogeneity in findings, such as by teachers' background knowledge or education level, will provide a better sense of how MOOC take-up differs across teachers and how future interventions can be designed to address such differences.

Data Collection and Analysis:

As described above, this study takes advantage of several rounds of surveying. Recruitment for

this study was conducted at the same time that detailed survey data were collected as part of the larger randomized study. At this time, we collected detailed survey information from school headmasters as well as from core mathematics teachers at each of these schools. The data collected from the school included information on its IT equipment and internet access, as well as on the management practices and characteristics of the headmaster. The data collected from math teachers included their demographic background, teaching credentials and experience, and detailed information on instructional practices. Additionally, we administered a mathematics knowledge test which includes questions that capture how well teachers are able to answer mathematics problem solving questions as well as questions that measure teachers' ability to teach mathematics (per Hill, Rowan, and Ball, 2005). Such questions ask teachers to identify student errors and choose the best strategies and techniques to employ in answering a variety of mathematics problems. Immediately following the survey and knowledge test, math teachers were provided with detailed information and instructions on how to enroll in the math MOOC. The MOOC was chosen both for content and because the platform provider was willing to provide very detailed click-stream data (i.e., detailed information on the timing and frequency with which teachers accessed the MOOC and in what capacity).

Findings / Results:
Despite this very light intervention, and the fact that most teachers do not have a personal computer, let alone an internet connection at home, click-stream records show that 50 teachers (9.2 percent) of the sample enrolled in the MOOC, though only five teachers earned a certificate of completion. The initial enrollment rate, while not large, does demonstrate some interest and demand for online instruction among mathematics teachers. Furthermore, enrollment was higher at more prestigious senior high schools (ranked by the Ghana Education Service as category A or B schools). One possibility for this higher take-up is the availability of better computing infrastructure within these schools and/or in the localities of these schools. Overall, the headmaster intervention did not result in any greater enrollment among the treatment group.

I am currently in the process of analyzing the survey and clickstream data from the MOOC provider to understand whether there were more heterogeneous effects and generally how take-up and course participation is related to school and teacher characteristics. Additionally, the collection of follow-up headmaster and teacher phone surveys were recently completed, and these data will shed more light on the initial findings and in particular in the null effects of the headmaster treatment.

Conclusions:
This study represents a necessary 'proof of concept,' which answers key foundational questions necessary for designing and evaluating a larger project in which teacher professional development and training can be provided through an online platform. In Ghana, inequities in educational access and outcomes are exceptionally troublesome, with students in rural areas significantly underperforming their urban counterparts (World Bank, 2012). Within remote and impoverished rural communities, teacher training is particular lacking (World Bank, 2012) and innovative ways to reach instructors in remote areas are needed. With the spread of internet in such communities, online courses hold tremendous promise. While little is known about teachers' awareness and demand for such courses, this feasibility study is an important first step in understanding whether we can leverage online resources to improve teaching and learning in disadvantaged communities.

Appendices

Appendix A. References

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