**Charles Severance: Teaching Philosophy**

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I have been teaching as Clinical faculty at the University of Michigan School of Information(UMSI) since Fall of 2007. My teaching career has spanned over 25 years, with teaching experience at Lansing Community College (1981-1986), Michigan State University (1990-1998), and the Computer Science Department at the University of Michigan (2000). Since 2012, in addition to teaching on-campus courses at UMSI I have actively participated in the University of Michigan partnership with Coursera, and currently teach six Massively Open Online Courses (MOOCs) on the Coursera platform.

*My approach to teaching is based on the desire to involve the widest possible range of people in the creating and active use of computer and network technology. I tend to teach introductory courses on programming and do so in a way to make the material as approachable as possible to students with no background in programming, mathematics, or statistics.*

My Python for Everybody specialization [PY4E] on Coursera is the best example of this approach in action. In 2016, my specialization was the #2 specialization across all of Coursera[Popular] and a regular on top-50 lists of MOOCs across all platforms[TOP50]. While there are thousands of Python courses and Python books to teach the "first Computer Science course (CS1)", my "Python for Everybody" book, courses, and web site [PY4EWeb] are dedicated to serving as the "first programming course" regardless of career choice or educational plans. This much broader applicability as a programming course makes my course somewhat unique and successful in terms of the number of learners impacted. As of June 2017, there have been a total of 646,259 registrations in my five-course Coursera Python specialization and 169,627 course completions of those courses.

The foundations for my success in Coursera from 2012 to the present were laid down when I was hired at University of Michigan School of Information in 2007. The purpose of my hiring was two-fold: (1) develop and teach programming courses to master's students with no programming background, and (2) participate in the founding and development of an undergraduate program (Informatics) that would bring some of our content and teaching approaches to the undergraduate level.

**Graduate Courses**

Over the years at UMSI, I have taught a number of courses at the graduate level:

* SI543 - Introduction to Java Programming
* SI539 - Design of Complex Web Sites
* SI664 - Database Applications
* SI502 - Networked Computing

When I arrived in 2007, all the courses except for SI502 were on the periphery of the master's curriculum. Typically, less than 10% of the master's students would take one of the technical courses and then often in their last semester of the two-year program.

In 2007-2008, we added the programming-oriented SI502 course to the curriculum as a "foundations" course and required that every master's student take the course in their first semester. I took over this course in Fall 2008 and will teach it through Fall 2017.

To serve all the incoming Master's students each Fall, SI502 could not assume any prior skills or knowledge of its incoming class. And furthermore, since about 50% of the incoming class was targeting a career in librarianship or social sciences, many students had an aversion to learning programming, and some had bad experiences with programming courses in their undergraduate education.

Given this as context, my goal for SI502 was not just to create a course that these students would "endure" because it was required, but instead to energize and excite them about programming so that they would take more technology courses (SI539, SI664) than were required.

I also knew that once I figured out how to teach this "first programming class with no pre-requisites" that it would be valuable outside of UMSI. So I adopted an approach of releasing all my teaching materials under Creative Commons early on.

I chose the Python language because it was a combination of simplicity and power and was seeing use in the emerging data analysis field. I searched for a textbook that was focused on teaching programming without introducing "Computer Science" too early. I decided I would write my own textbook and in January 2010, I published "Python for Informatics" [PY4INF] printed on the local Espresso Book Machine (EBM) at the UM Library which I used as the textbook for SI502 during Winter 2010. I could produce a book in six weeks, because I started with an existing free and remixable Python textbook titled "Think Python" [Think] and removed the "Computer Science" references.

I released the book as free, open, and remixable, but because of copyright disagreements with a publisher who had published a different version of the textbook, I had to wait until 2013 to publish a print version of the book.

Early in 2012, the University of Michigan was one of the four founding institutions of Coursera and I was fortunate to have been one of the first six instructors invited to participate with Coursera. My first Coursera course in 2012 was "Internet, History, Technology, and Security" [IHTS] which was based on two weeks of SI502 where I introduced networking with a historical focus. In April 2014, I introduced two courses (Programming for Everybody) on Coursera based on the Python aspects of SI502 and my free/open "Python for Informatics" textbook. These courses ran through Summer 2015 and had over 600K enrollments.

During the summer of 2015, we re-factored and expanded the two-course "Programming for Everybody" into a five-course Coursera specialization titled "Python for Everybody" (PY4E) which was rolled out September 2015. In 2016, I revised the course materials, text book, auto graders, and videos to be Python 3.0 and in June of 2017, we converted the specialization to Python 3.0. Early in 2017, I gathered all the free/open materials and software to support the course into a single web site (www.py4e.com) with an embedded Learning Management System that I wrote to support teachers who would adopt my textbook and/or allow students to take the course for free outside of the Coursera platform.

*Beyond Python*

There are similar stories of how courses I taught on HTML, CSS, JavaScript, PHP, and SQL and technology curriculum evolved over since 2007. The short summary is that the SI539 course with through several iterative improvements and has produced the "Web Design for Everybody" [WD4E] specialization that is taught by Colleen van Lent. I iterated the SI664 course over several years and it has produced the (soon to be released) "Web Applications for Everybody"(WA4E) [WA4E] specialization for Coursera. The WA4E specialization also has a companion web site at www.wa4e.com.

*Impact on the Master's Curriculum*

From 2007-2013, as we (plenty of credit goes to my colleague Colleen van Lent) improved the technology courses we greatly increased the number of our master's students taking technology courses. Courses that in 2007 would be taught once per year for 25 students, by 2012 were being taught twice per year with 80+ students per semester. We greatly improved the technical skill level of our Master's students during that period.

From 2013 to the present, our overall master's curriculum began to evolve to be more technology oriented with a focus on data mining as a core skill that was expected of all graduating students. By 2016, the required SI502 course was to be replaced by a more rigorous two-semester SI506/SI507 programming sequence to be taken in the first two semesters of a master's student's program.

Fall 2017 will be the last time that SI502 is taught as it is now seen as "not rigorous enough" to progress the incoming students to the desired level of technical prowess by the end of their first year. But since some of the incoming students still may not have the background to keep up with the pace of SI506, we encourage incoming students with a weak background in technology to take the Coursera "Python for Everybody" Specialization or my open Python course on www.py4e.com.

In a similar manner, I expect that over time there will be increased expectations on the rigor of the SI539 and SI664 courses once the Coursera specializations for the "entry level" materials are well established.

**Undergraduate Program**

When I arrived at UMSI in 2007, one of my tasks was to help build the undergraduate Informatics program [Informatics]. Informatics was shared between the School of Information, College of Engineering, Department of Statistics, and Department of Mathematics. The curriculum was jointly developed across all four organizations and UMSI was to provide the data analysis courses and networked thinking courses as well as coordinate the Social Computing concentration.

I developed three courses for the undergraduate program:

* SI182 - Building Applications for Information Environments
* SI301 - Models of Social Information Processing
* SI364 - Database Applications (essentially a clone of SI664)

These courses were adapted from the material in our master's program.

I was one of the two representatives from UMSI that participated in the Informatics program from 2008-2015 and was the advisor for students taking the Social Computing concentration during that time. The Informatics program was quite successful with solid yearly growth over the seven-year period.

In 2012, UMSI started planning for its own Bachelor of Science in Information (BSI). I was part of the planning for the BSI and was involved in the transition from Informatics to the BSI when it rolled out in 2014. Once the BSI program was fully rolled out and the Informatics transition was complete, my involvement in the BSI was significantly reduced. By that time, I had become deeply involved in the UMSI offerings on Coursera and was actively mentoring faculty as they would produce their own courses and specializations on Coursera and edX.

I continue to teach SI364 in the undergraduate program but am not involved in any leadership role at this time.

**Conclusion**

Teaching technology courses at UMSI during the past decade has been the perfect "laboratory" to make progress on expanding access to high quality technical education for "everyone". Because I was on the leading edge of developing and evolving technology courses in our master's and undergraduate programs, I could try new ideas and change my materials and approaches every semester. Because so much of the courses we were developing were "new territory" it was OK for me to research, explore, innovate, and iterate as I taught.

In 2012, after five years of experimentation with my on-campus teaching and open educational resource materials, the Coursera opportunity came at a point where I was well prepared to move quickly into the new space and enjoy the success that often comes to "first-movers".

Since 2012, the overall direction of our master's and undergraduate programs at UMSI has become increasingly technical and rigorous. I continue to see my role as making sure that these new programs continue to be accessible to the widest possible range of students, regardless of their prior course work or skills. I would like to think that having the very basic and introductory open / free courses is one of the enabling factors that has allowed us to rapidly improve the technology aspects of the UMSI programs.

In a sense, even though the SI502 course I loved and taught from 2008-2017 to 100+ students per year is being retired, it is not going away - it has evolved to a new form as a Coursera MOOC and free course materials that touches millions of students all over the world.

**Looking Forward**

One of my unique activities as a MOOC instructor is to have face-to-face office hours with my students around the world [Office]. This gives me a unique opportunity to understand how MOOCs can affect the learning arc of students.

The overwhelming conclusion from these conversations is that students who take the "Python for Everybody" specialization on Coursera have a wide range of effects once they complete the courses on Coursera. Sometimes they go on to further education. Sometimes the evolve into new roles in their current job. Sometimes they become employed for the first time in a long time. There are many examples of students who have had significant improvements in their career taking as few as two Python courses.

But I aspire to a far greater impact than that which several Python courses can achieve. Back in summer 2015, Colleen van Lent and I mapped out three Coursera specializations that we felt would take a student from no technical skill through an entry level job in web development:

* Python for Everybody
* Web Design for Everybody
* Web Applications for Everybody

Back in 2015 we planned 13 courses across three specializations with a gentle learning curve across all the courses with an ultimate goal of being prepared to start a career as a web developer.

It has taken two years to build and roll out the courses and specializations. The last of the original three specializations (Web Applications for Everybody) is scheduled to roll out in the Fall of 2017. This will complete what we planned back in 2015. While there are Certificates and "Micro-masters" in the MOOC space from Coursera and edX, we feel that this will be the first program anywhere in the world that is aimed at providing free education in life-changing skills to those that need them the most.

It may take some time and a number of iterations, but if we are successful, we will hopefully have a measurable impact on expanding the number and diversity of ready-to-hire software web developers.

**References**

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