Technology Platforms will NOT Democratize Education

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ABSTRACT

The popularity of online education platforms keep rising. Well-known Massively-Open-Online Courses (MOOCs), such as Coursera, Udacity, and edX, have enormous growth not only on the number of enrollments, but also published many excellent course programs. These platforms hold great democratic promise[2] initially. Several programs, such as Chromebooks or One-Laptop-Per-Child, combined with low-cost and plenty of content, aimed to give more educational opportunities for everyone. However, these promises doesn’t equal democracy education. Some issues, such as the uneven distribution of education resources, unsolved by these platforms. Rather, this new type of education raised new challenges for education democracy, which even enlarged the gap between those elite parts and the general part. In this report, I summarized the issues that online education encountered when trying to achieve democracy.

KEYWORDS

Remote Education, Democracy, Technology Platforms

1 INTRODUCTION

Beginning with the emerge of Online Education from the 1990s, various new educational technologies have entered the world. Compared to the traditional education which usually transmit knowledge through class, new educations aim to "splash" the knowledge outside the class. Hence, most of the new education platforms have a remote structure and incorporating different technology platforms to bridge the gap between teachers and students. Multimedia makes various types of educational forms, including videos, films, audio textbooks, online assessments, virtual conferencing, and even live shows.

Combined with this technical support, new educational technologies, such as MOOCs, can provide low-cost educational resources for most of the students. In this way, technology platforms have several properties to democratize education.

- First is the cheap price education make the education more acceptable for students with economic. every virtual class can be accessible for a very large number of students. There are some statistical data shows that the online education prices[3], no matter private or public, are going down and cheaper than the traditional one.
- Second is they are easy to access and their content can be acceptable for a lot of students. For example, a machine learning course on Coursera published by Stanford computer scientist Andrew Ng had an enrollment of over 2.9 million up until now and the student registered for this course comes from 190 different countries.

- The Third part is flexibility. Most online courses are separated into several pieces in which students can watch the video record repeatedly to match their study speed. So, the study time can be scheduled automatically by students. And since the knowledge is fragmented, for those students with some background can skip the part and go to what they want directly.
- The final one is the large amount of content. Study resources online can be enormous, the same knowledge points can have various types of tutorial form. Students can then not be restricted by the limited teachers they encounter in the real world. There are too many choices online, and students can choose their best fit.

With all the advantages listed above, a claim that "future should belong to open courseware" raised since 2001 [6], and many education tech boosters start to join and build this community for education.[7] And the technology platforms keep growing since they start, up until now. Take MOOCs for example, in 2015s, there are 500+ universities, 4200 courses, 35 Million students have registered in this community [9]. When it comes to 2018, the number grows to 900 universities, 11.4k courses, and 101 million students [10]. With all the flourishes that technology platforms achieved, some people say the technology platforms will finally democratize the education.

However, the new form of education based on technology platforms doesn’t equal education democratize. First, there are claims that we can use online courses to replace the traditional course study, but some education resources are not cheap online and some are not acceptable by the new technology. In this case, the differences between people who can access it or not doesn’t change.

Second, a lot of education start-ups and reports has mentioned that cheaper price of online education help more people access to education resources. However, more people can access to education resources with lower prices doesn’t equal to more people truly involved in the education process. The growing number of students register on the MOOCs is a big bubble, only a small percentage of students have accomplished the courses.

Third, some people may claim that at least more students start to access education resources which they didn’t have opportunities to access before, so whatever the issues the technology platforms remain, education is going to be more democratized than before. But on the contrary, the gap between people whose education at different levels can be further enlarged in this digital world. Individuals with high motivations, advanced study methods and more money to buy premium level courses can study online with amazing speed. Some people can even accomplish the 4-year courses at MIT in one year based on these platforms. But the study speed on the other side didn’t change too much considering the accomplish rate for online courses. Finally, the technology platform may compromise the democracy in some form that traditional education doesn’t have. Some of the issues above may be modified in the future with
better technology but the rest may not be figured out in the future tendency.

2 REMAINING
In this part, I will address the issues that encountered both in traditional education and new technology platforms. Those hindrances are the unevenly distributed educational resources, study motivation varies among individuals, and the teaching qualities from different resources can have huge gaps.

2.1 Scarcity of resources
The new technology provides enormous online study resources. In nowadays, almost every text or video-based knowledge can be searched through the Internet. However, some parts of them are not free and on the contrary, they may cost much. Besides from those technologies that prevented by copyrights, many research papers and textbooks even electronically based can be very expensive. These resources are the pivot for some study areas, especially cutting-edge technologies, since only academic-related institutions will buy the privilege of reading them even though most of them are created for the public. In this case, the high-level educational resources didn’t become cheaper and easily accessible from most individuals.

Besides, on the elementary part especially for some hard sciences (physics, chemistry, biology, etc), completing physical experiments is essential for the study process, and technology platforms cannot replicate real substances involved for everyone. Some may argue that the online experiment simulators such as the virtual chemistry and simulations on American Chemistry Society(ACS) or PhET Simulations for physics experiments can replicate results of low-level experiments. However, all the results that the simulator gives out can be found or derived through the textbook, it just visualizes this knowledge not replacing the experiment. For example, when I tried to use the chemistry simulator on ACS to do an elementary chemical reaction, simply dissolving some Na₂CO₃ into water with some target concentration. The process is simple, and in a simulator, I only need to click the button, choose the amount of Na₂CO₃ I want to add, and drag it into the flask and stir. However, the details in the real situation can be different. Take the weighing process for example, when using balance to take some chemical powder in a defined weight, I need first to check out the balance state, adjust it if the platform for weighing is not parallel to the ground. For the high precision balance that laboratory use today, the precision can reach to four decimal places at the unit gram. And this precision means, even an expiration on the balance platform can lead to value vibration on the balance. So, the balance usually has a glass cover to prevent any airflow influence. Every time we scoop some reactant powder from the reagent bottle and place them to the platform, we need to close the door on the glass cover to read the weight value. When we required to achieve the weight in a very precise value, every reactant adds-up needs to be very careful, and all the excess part needs to be discarded due to any potential pollution. And for the reactant I choose: Na₂CO₃, it has a strong ability to absorb water in the air. So when you take some of it put on the balance table, and close the glass cover, you will notice the value increase later on. So, weighing this reagent needs to be done quickly to minimize this error, and for some reaction water is not allowed, the whole process needs to be accomplished in a vacuum drying container. All the details I mentioned above is only one value input and one button click in the online simulator.

We can also find out that knowing is different with actual operation, and this is a new challenge raised for technology platforms, I will further explain it in the later part.

2.2 Motivation Problem
Though most knowledge can be easily accessed through the Internet, the motivation to study can vary drastically among individuals. Traditional education has some mechanism to push everyone’s motivation to extend to some level but for technology platforms, the study willingness is almost based on the individuals. In this case, students prefer to easy and elementary courses instead of hard courses. This is easy to understand, and we can easily check the different amounts of enrollment between courses at the same level of study path with different levels of difficulty. One basic example is the programming language study. For every new programming student, their first step is to choose a programming language for studying. And generally, most students will choose a language from C/c++, JAVA, and python. If we search the fundamental course on the Coursera for these three languages, we can easily find that the top fundamental course for python has 1.4+ million students registered, JAVA has 360k+ students registered and the number for C/C++ is 83k. We all know that they are popular languages both in development and production, and the hardness to learn them is C/C++ ≈ JAVA ≈ Python. So the result is clear, more students will choose to start with the easiest one.

Besides, the study process is not easy for everyone, some courses even with a high rate of enrollment, only a few students can stick to the class to the end. Two researches have provided data to prove it[1] [8]. In the paper The MOOC Pivots[8], published by Reich and Ruiperez-Valiente, the authors showed the collected data for students who registered the MOOC class in Havard and MIT university. The statistic contains data from 2012 to 2018 with 5.63 million learners in 12.67 million course registrations.

The result of the complete rate is shown in Figure 1. We can see that only 6 percent of participants completed their courses in 2014-2015 and this rate keeps going down to 3.13 percent in 2017-2018. Besides, even the students paid for verification only have a complete rate 50%. The courses’ low completion rate on those platforms demonstrate that easy-access account less for the final result. So, even though easy-access is a good start, the new technology platforms for democracy on education can have little performance compared to the number of people who accessed that.

Another proof for the motivation problem is the unique retention users decline drastically and the retention rate keeps decreasing with the time. In figure 2, the data collected the number of users they enrolled for the first time and the number of them if they keep enrolling courses in the following year. As the data shows, this rate also dropped quickly from an initial 38 percent in 2012-2013 to only 7 percent in 2016-2017. All these data imply that, the positive data(a large number of students enrolled, courses published) and the flourish of technology platforms are not solid.
The study motivation may be influenced by the endowment effect; in short, the value of gain is much less the value of loss. And this can answer to the figure 1 that those paid for study have a higher rate of completion. But when students need some type of loss to push themselves for study, then the cost for knowledge becomes high, democracy on education compromised.

On the other side, let’s take a look at those who are benefited most from the technology platforms. As a student in university, it is common for me to search on the Internet for answers and support for the difficulties I encountered in the real class. Most of the time, I only registered a course for the part I’m confusing, took that part for learning, and then skip the last. I have to admit that these courses online helped me a lot since I can quickly find the key points or even learn the course again by following the online resources. Most of the students around me will do this, systematically study the whole framework in a real class, and check the specific details or gaps on the Internet. I have to admit, online resources are good supports for our study. But for people who haven’t access to the areas related to the questions we searched, they will not generate related issues and less likely to study like the style I mentioned. And this differences can enlarge the gap.

Another example is for those with very strong study motivation. I subscribed to the well-known MIT challenge which is created by Scott H. Young. The challenge is to accomplish the 33 computer science courses at MIT within 12 months. He recorded his study path and published a book for this experience. For me, I’m not a man with such strong motivation, so I quickly give it up. But if we took a look at his experience, we can see that people like Scott are those who benefit most from the technology platforms. They learned many more courses outside the classical courses, and some of them even paid for the online trainer or premium courses to further accelerating their study pace. And for people who satisfied the conditions above must have a high probability that already studied in the high-level education Institutions. I accidentally know someone who accomplished at least 10 MOOCs each year. Originally, he has a better education background than me, and now with the resources provided by technology platform, I can feel the knowledge gap keep increasing between us.

As a conclusion for this part, the most benefited students are still those with a good motivation for study and within to pay time and cost to achieve knowledge. And it is very likely, they already have high-level education backgrounds.

2.3 Quality of online study

The third problem is the quality of the online study. As I mentioned before, there are plenty of resources on the websites, and when we want to search the answer for some problem, just google it. However, some online resources are not well authorized. Take an online platform Udemy for example. Many learning projects posted on that are not from academic resources, and for lecturers who want to publish a course, the description and the authorization is all based on themselves. There is no certified third party to ensure the quality of the course. So, the content in the course has no guarantees. For a learner, it is hard to judge the right or wrong contents in the courses. And some low-quality courses may also use high discount for learners to buy, which enlarge the differences between those with highly paid and those paid less or only take free courses.

Another situation is that, for those authenticated teachers, they may reduce the difficulties of courses to make them more acceptable for entry-level learners. In this way, the course quality may be compromised. Take the well-known Stanford machine learning course on Coursera as an example again, if we compare the syllabus of this online course with its original one, cs226 in Stanford, we can see its content shrunk: the online one has 56 hours materials to read and watch and 11 weeks recommended for accomplish, but the original one needs to take four months study. Not to mention the comments below the course say they waive part in the online
version. For professors who don’t want to reduce their courses’ difficulty, their courses will receive less attention. Last year, when I studied on the operating system (OS), I have some difficulties while learning that, so I searched on the Google to find extra tuition for support. I accidentally find an online course about OS published from Georgia tech. This course is constructed comprehensively, from the basic knowledge for beginners like me and the high-level OS design from the latest paper before the course publish time. It was published on the Udacity, and it is a free course. I learned a lot from it, and appreciate for this professor. But when you take a look at it, you will find that only a few students have registered this course and the number of comments is less, it even didn’t pop up on the first page if you search operating system on Udacity.

Online courses also have limited ways for interactions and practices. These are drawbacks inherent in the technology platforms. And these drawbacks further harm the democracy of online education, since some students can pay for trials, take high-quality courses, or even alive courses, but others can only take the free or low-quality ones. I will discuss this in the next part.

In this way, the quality of the courses between online education and traditional education still large. Authentication of the education quality is still a problem for these technology platforms. For most of the time, they provide authentication manually, such as Udacity, but the users need to pay a high tuition fee. Thus democracy of education still not achieved as those education tech booster’s expected.

3 NEW CHALLENGES
Despite the issues faced both in traditional education and a new type of online education. The education provided by the technology platforms triggered some new problems which diminish the democracy of the education it provided.

3.1 Social Interaction
First is the lack of social interaction. The courses I mentioned above are all about technical subjects and most of them only need to care about the true answer. But for humanity courses or art courses, social interaction is the essential part. Only with the thinking and discussion with other students or face-to-face talk with professors, critical thinking can emerge. Some papers do the survey on that and a lot of participants stated that online education limits the opportunity to share ideas, combine with others, and reduce communication efficiency. Since social interaction doesn’t have a final true answer, discussion and writing essays or papers are the core of these courses but they are hardly acceptable for courses on the MOOCs[5]. If we search on these humanity courses on these platforms, most of the courses consist only of videos, reading materials, and quizzes of multiple choice. Though, students can leave comments online with other students and give assessments to each other for some assignments, but face-to-face discussion with the professor is usually missed. So the interaction here is still limited. Here knowing is different from skills, a person practicing speech skills every day in a class can stronger than others only read a book named "How to make a good speech".

3.2 Practical Experience
Another part is knowing is different from practical actions. Not all knowledge can be visualized and virtually put onto the Internet and evenly distributed to everyone, especially for those experiments based on study such as chemistry, biology, and medicine. Take a chemistry experiment as an example: Sodium hydroxide mixed with hydrochloric acid can produce water and sodium chloride (\(\text{NaOH} + \text{HCl} = \text{NaCl} + \text{H}_2\text{O}\)). When studying this reaction formula, most students care about the reactant, product, general reaction condition, and reaction mechanism, and that’s what a textbook or a general lecture in the classroom usually focused on. When it comes to experimenting, other issues come out: the standard operations for safety or the details when mixing the reactants. Bad operations may trigger serious problems like mixing too quickly may cause a glass bottle to break due to temperature rising too fast. And details may lead to other new investigations: making tricks on the mixing process can output NaCl which has special nano-structure, and this is widely used as a base for special semi-conductor product[4]. Here, to implement an experiment real substances are necessary, such as a laboratory, instruments for reaction, and all the reactants. Since real substances are limited, education based on that cannot be democratized.

As I mentioned above in the scarce resources, experimental experience cannot be visualized into text or videos. Here, not only experiments but also other real work experiences cannot be emulated by these technology platforms. When we trying to find a job, one of the most important parts of our work experience. Since work experience is a solid criteria that even traditional education can hard to emulate, not to mention those technology platforms mainly based on screen and microphone.

3.3 Reliance Recommendations
The third issue is derived from the enormous education content in those technology platforms. Since there is too much information on the websites and its hard for us to choose a one for learning, most people choose courses based on recommendation systems. In other words, if students only study follow the recommendation system, they may lose the chance to diversely get different knowledge. It is common for the theater effect that when some courses gain some reputation based on rating, people making a selection based on the recommendation will keep participating in this course, and most of them may leave a high rating for this course. In this way, other courses on similar topics can be ignored. There are plenty of AI courses on the Coursera, but only get 2.9 million enrollment, the closest one only has 580k enrollment and it is also published by the same professor. The course has a very high quality, but this doesn’t mean it is the only form of that part of knowledge, for here the machine learning. If only one form of education is accepted by people, this can hardly identified as democracy. On the contrary, this effect can have huge bias and even totalitarianism, and due to the form of these education platforms that one class can be offered to millions of people, the tendency of centralization increased on education.
4 FUTURE PERSPECTIVE

Technologies are growing fast and some issues may be modified in the future such as the technical issues, the online education form can be hard adapted by some students. Here, I want to discuss the transformation of online education in the future.

The first part I want to discuss is virtually emulating the real substances through instruments like VR and AR (VR class) to simulate the real world instead of some experiment simulator. Well, in my opinion, the simulation of the real world is extremely hard and currently no computer can emulate all the dynamic status of molecules in a cup of water. On the other hand, if computing technology strong enough to reach that point, this kind of skill may not useful, we can simply create a robot for that and this situation extends the range of this paper.

The second part is that if one day the artificial intelligence works well enough to give the right judgment on our comments and art courses. Well, for the current level AI, detecting typos and give elegant sentences for writing is the best they can do. If they are smart enough to give judgments on critical thinking, then not only education needs be changed, all the society will change, and that beyond this discussion.

In my opinion, most of the elementary and medium level knowledge can be democratized to the public with the support of technological platforms. But for the knowledge on a high level, consisted of critical judgment and cutting-edge researches, this new form of education can hardly have the same effect on that.

5 CONCLUSIONS

Online education technology platform involves the use of the Internet for teaching and learning. It enables the education not limited by the time and places. The emerge of them make education low-cost and easy to access. However, the results of these efforts do not equal to the democracy of the education. Some scarce education resources cannot evenly distributed, which means these platforms have limitations on paid resources and real substances. And easy access cannot lead to the tremendous growth of courses study, since the individual study motivation can rarely help most people to complete courses. And easy access may make people reduce the value of knowledge due to the endowment effect. Besides, the quality of education on these platforms can not be well authenticated and some parts of the study like social interaction and practical experience cannot be emulated through these platforms. Finally, the inherent of the big data and recommendation system may hinder the diversity of online study resources. In sum, technology platforms will not democratize education.

REFERENCES