

How to make MOOCs work for ULTA: Action Plan

Andrii Zahorodnii

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Executive summary

For the yearlong period in the curriculum of Ukraine Leadership and Technology Academy (ULTA), there is great potential in using MIT course materials freely and openly available through MIT OpenCourseWare. However, one must be careful when introducing Massive Open Online Courses (MOOCs) into the educational program, as there are important shortcomings of instructor-guided learning at scale that can undermine ULTA's success. Namely, the main cited problem with MOOCs is the extraordinarily low course completion rate (often below 10%) which is only exemplified for students from less-developed countries, students from lower socioeconomic status, and students that haven't previously attained higher education.

In review of existing evidence on various techniques to improve student engagement and course completion rates, I make the following recommendations for how to best run ULTA:

- ❖ ULTA should pair MOOCs with offline meetups and mentor-guided study groups, mimicking as closely as possible the flipped classroom environment.
- ❖ ULTA must allow flexibility in course selection to promote connected learning, tying academic learning to personal interests and external peer communities.
- ❖ To mitigate the demographic misalignment between Ukrainian high school students and typical MOOC users, ULTA is recommended to employ value affirmation and social belonging interventions.
- ❖ ULTA should introduce course selection and course drop forms. They could serve a dual purpose - administrative and motivational. They would help students reflect on their motivations, thereby dissuading them from dropping out.

When implemented, the mentioned interventions and design principles are expected to encourage student participation, improve student perceived satisfaction and sense of belonging in the group, and raise course completion rates.

Introduction

Summer camp I 2 weeks in August 2023	Yearlong September 2023-April 2024	Summer camp II 2 weeks in August 2024
In-person, with MIT mentors, focus on professional skills	Study two MIT courses online using MIT OpenCourseWare. Focus on technical courses.	In-person, with MIT mentors, focus on applied projects

Figure 1. Structure of ULTA 2023-2024.

What is ULTA? Ukraine Leadership and Technology Academy (ULTA) is a tuition-free educational program for Ukrainian high school students in grades 9 and 10. The aim of ULTA is to provide its participants with the skills, knowledge, and confidence they need to rebuild Ukraine into a thriving, European nation (ULTA 2023). Specifically, the learning outcomes of the program can be summarized as obtaining (i) technical skills in a chosen of STEM and (ii) leadership and professional skills not typically taught in Ukrainian curriculum. To achieve these aims, ULTA 2023-2024 is structured as shown in Figure 1. Given scarce available resources, in the yearlong period ULTA will take advantage of resources openly available through MIT OpenCourseWare (OCW), an open, free library of materials from thousands of MIT courses (MIT OpenCourseWare, 2023).

In principle, OCW makes it possible for any person in the world to obtain a world-class MIT education for free, all they need is an internet connection. This is perfect for ULTA. For the most popular courses, all content is available, including lecture videos, recitation notes, problem sets and solutions, and all course exams. Those resources are what makes the ambitions of ULTA's yearlong plausible, given that mentors will only be available online and only for an hour per week. Most content on OCW is organized in the form of Massive Open Online Courses (MOOCs). MOOCs are online learning experiences available to anyone with an internet connection, offering the opportunity to partake in free or low-cost educational courses on a vast array of subjects (Pappano, 2012).

Initially, it was believed that MOOCs would democratize access to education and knowledge, breaking down geographical, financial, and time constraints (Friedman 2013). MOOCs have the capacity to enroll hundreds, thousands, or even millions of learners simultaneously, thus the term 'massive'. The 'open' in MOOCs refers to their general accessibility to the public, regardless of prior education or experience. Courses are usually self-paced, meaning students can complete the coursework and assessments at their own convenience within a given timeline.

A big problem with MOOCs can threaten ULTA's success

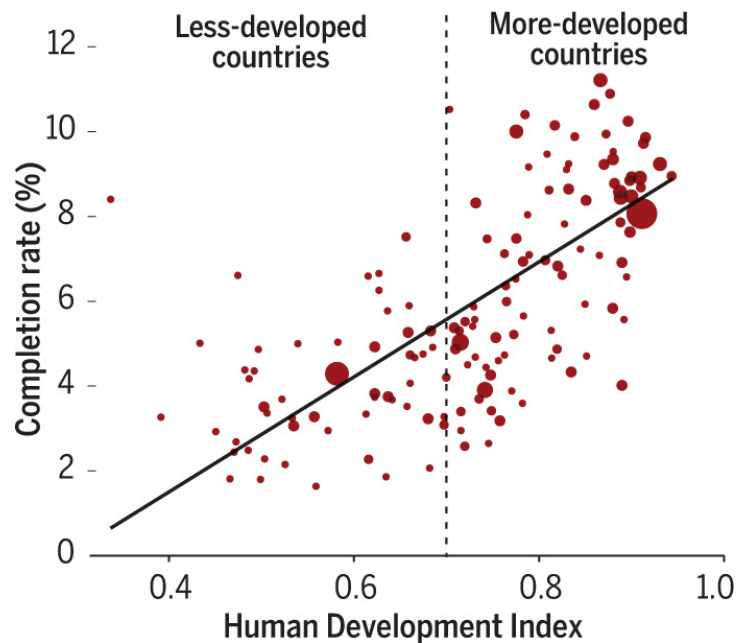


Figure 2. MOOCs are more frequently completed by students from more-developed countries. Adapted from Kizilcec et al. (2017).

Overall, MOOCs failed to deliver on the promises of democratizing education and breaking down socioeconomic barriers. The initial excitement and optimism around MOOCs' accessibility to wide populations were hit with very low completion rates, with most courses having completion rates below 13% (Onah, Sinclair, & Boyatt, 2014, Jordan, 2015). Furthermore, MOOCs seem to work best for people of higher socio-economic statuses who already have some form of higher education. This is evidenced by higher completion rates by students from more-developed countries (Kizilcec et al. 2017; Figure 2), as well as by the finding that MOOC users (in the United States) generally come from neighborhoods with higher average median income and higher average educational attainment (Hansen & Reich, 2015).

This shortcoming may pose a problem for ULTA as its student profile does not align with one for which MOOCs work best. Participants of ULTA 2023-2024 will not come from rich families and have completed higher education, but rather they will be high school students, potentially coming from vulnerable regions of Ukraine that suffered greatly from the war. Furthermore, before the war (in 2021) Ukraine had the Human Development Index of 0.773 (United Nations Development Programme, 2021), suggesting an average MOOC course completion rate of around 2-6% (Figure 2) – far below the expectation for ULTA, which needs to be close to 100%.

Fortunately, there are remedies with a track record of improving student participation in MOOCs, raising completion rates, and improving student perceived motivation and satisfaction. Here, I discuss three ideas and their supporting evidence. I give recommendations on how they should be implemented in ULTA's curriculum to improve outcomes.

Remedy 1: Meetups and flipped classroom settings

There may be many reasons why students tend to drop out, but one cited reason is the lacking social component of MOOCs: lack of interaction with the instructor (Hone & El Said 2016) and with other students (Chen & Zhang 2017).

Meetups – group meetings with other students taking the same MOOC – have been shown to improve the students' perceived sense of belonging (Gamage & Whitting 2021). Students in the meetups group scored higher on metrics of feeling understood, connected, welcomed, feeling respected by others, mattering by others, and the overall happiness in the group.

Nan et al. (2014) investigated offline collaborative video viewing (CVV) for MOOCs. They found that watching lecture videos synchronously is a desirable attribute, and that in particular having a centralized display (where the lectures are played) but distributed controls (such that any group member can pause the video at any moment) promotes discussions among the group and may be a good balance between synchronicity, video interactivity and discussions.

It is thus desirable for ULTA to assemble students into small groups based on the MOOC they are taking. ULTA should encourage students to watch lectures synchronously, as opposed to separately. If all students in a given group live close to each other, they can assemble offline; otherwise, online watch rooms can be used. A watch room service can be found which shows every participant the same video content, and where every participant can pause the video at any moment to discuss or ask a question.

Furthermore, studying in a flipped classroom arrangement has shown good results, often with 100% completion rates in small groups (Zheng & Pinkwart 2015). Accordingly, ULTA should structure its yearlong to mimic the flipped classroom setting as closely as possible. Although instructor time is not available, ULTA can have as MIT mentors undergraduates who took the corresponding course at MIT. This way, the session with the MIT mentor can be similar to a usual recitation at MIT.

Remedy 2: Value affirmations

Value affirmation interventions have been shown to improve course completion rates in less developed countries (Kizilcec et al. 2017a) and for student populations that perform worse on average in the course and are at-risk (Kizilcec et al. 2017b). Value affirmation interventions (as defined in those studies) are one-time questionnaires that a student must fill out before beginning the course. Students are asked questions about the values and qualities that are the most important to them, and how taking the particular MOOC will reinforce those qualities. Additionally, the authors find a social belonging intervention helpful, where students are asked to reflect on how they think the course might go for them, based on prior experiences of other people in the course (“it was daunting at first, but in the end I’m happy I took the course”).

The evidence on the effectiveness of these interventions is preliminary. A follow-up study by Kizilcec, Reich, & Yeomans et al. (2020) found the effect to be an order of magnitude lower than previously reported, and only in certain courses (namely, in courses where there exists a global achievement gap between more- and less-developed countries). However, as those interventions are easy to deliver, and the ULTA student population is out-of-distribution of a typical MOOC user base and thus at-risk of dropping out, this idea remains worthwhile to try to consider implementing at ULTA.

All studies mentioned so far only study value affirmation interventions delivered once right before taking the course. There is no evidence to suggest that this timing is optimal, and that one intervention at that moment is enough to give best results. For example, Leider, Strobel & Tappert (2021) describe a course design where multiple interventions are delivered at various low points throughout the student’s journey through the course. Possible low points where the student might feel discouraged and is likely to drop out of the course can be predicted based on the details of the course and the student’s demographic.

Remedy 3: Connected learning

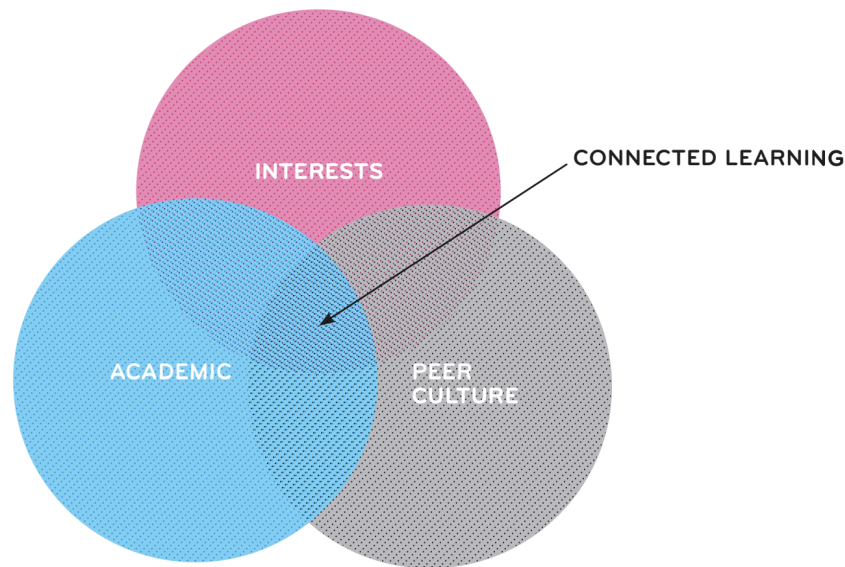


Figure 3. Connecting the Spheres of Learning. Adapted from Ito et al. (2012).

A prominent feature of case studies where best learning outcomes are achieved is that the students' interests outside of academics overlap with the coursework topics, and in this way the learning was not just for the purpose of it but rather in service of the outside interests (Resnick et al. 2009, Ito et al. 2012).

Ito et al. (2012) have studied this phenomenon and developed the Connected learning framework. Connected learning refers to learning experiences which happen at the intersection of academics, student's interests, and peer culture (Figure 3). In the case of taking MOOCs, connected learning may mean that the students are taking the course because it provides knowledge or skills directly applicable to an area of their interest, and that the student, once they acquire this knowledge, will be perceived more highly by their peers or in some other way will be better included or more involved in their peer culture.

For ULTA, it is thus important to design the learning process such that it lands students at the intersection of academics, interests, and peer culture, landing them the benefits of connected learning. The primary way to achieve this goal is to make for a flexible selection of the MOOC courses that the students will take, and encourage students to select courses with topics that align with their interests outside of school and for which there are communities that they could join or are members of.

Conclusion: Action plan for ULTA

Given the evidence described above on how to improve student participation rates, course completion rates, as well as student perceived well-being and satisfaction in the course, in this section I present recommendations for how to structure the yearlong of ULTA to have the highest chances of achieving best results.

Meetups and flipped classroom: ULTA should structure its learning environment as closely as possible to the flipped classroom setting. Students should be assembled into small groups, with every small group taking the same MOOC. To every small group, an MIT mentor should be assigned, and they should meet with their group regularly (weekly) to run recitation for the course. Outside of the meeting time with the MIT mentor, the group should be encouraged to watch the video lectures together. To achieve optimal results and promote group discussion, the group should be provided with a centralized display where the video is played, and every group member should have their own controls to be able to pause the video at any time to ask a question or discuss with their classmates. If possible, groups should be encouraged to meet offline, however it is likely that all meetings will have to take place online. To compensate for the lacking face-to-face component, and since resources are available, I recommend arranging offline cohort meetings where all ULTA 2023-2024 participants (and not just one group) can catch up with each other's progress and socialize. Those offline meetings should keep the ULTA 2023-2024 cohort connected and feeling as one big cohort.

Connected learning – interests: ULTA should have a flexible curriculum that allows students to have some freedom as for which MOOCs to take. This way, students can pick materials that are relevant to their interests outside of school and connect studying the MOOC to their goals. ULTA should offer only introductory MIT courses which can realistically be taken by (intelligent and talented) high school students.

Recommendation for a shortlist of courses from which to offer is given in Table 1. This shortlist includes only those courses for which all content is available on OCW (lecture notes and videos, problem sets, and exams), and only courses which either have no prerequisites or only have those prerequisites that a Ukrainian high school student can reasonably have, given prior experience in the topic.

Connected learning – peers: The flexible course selection procedure should place students into the intersection of interests and academics. The remaining important piece to make connected learning effectively work is the peer culture (Figure 3). To get the full benefit, it is thus important to find, for every program participant and every MOOC, what are the people in their lives (outside of ULTA) that will comprise those communities. This

step can be done by the participants themselves, if they are encouraged to think about communities they are or will become part of that will support their learning.

Value affirmations: As Ukrainian high school students are out of distribution for a typical MOOC student, ULTA should implement value affirmation/social belonging interventions throughout the course. Initial course selection form should ask how taking the course aligns with their interests and how it promotes their values (value affirmation), as well as ask students to reflect on the social belonging prompt (short answer). This step completes the initial intervention. Since ULTA will have the ability to contact student and student groups throughout the yearlong period, it is suggested (and might be desired) to deliver a second intervention to individual students when they are at risk of dropping out of the course. The details are described in the next two sections and Tables 2 and 3.

Course selection form: To collect course preference information, a form will need to be sent out to all ULTA participants. This form is a great opportunity to make sure students are encouraged to think about how to better connect their learning in the MOOC to outside interests, as well as deliver the first value/social belonging affirmation at that time. The recommended structure for the initial course selection form is shown in Table 2, and it combines course selection with interest & peer community statements, as well as the value affirmation/social belonging question.

Course drop form: To avoid cases where students can't keep up with the course and as result become unresponsive, ULTA should have a "course drop" form. This form may be a good time to deliver the second value affirmation / social belonging intervention. This intervention can consist of a reminder to the student of what they wrote previously about the MOOC being aligned with their interests and promoting their values. Hypothetically, a student that is at their low point in the class will be looking through this form in contemplation of whether to drop the course, and an intervention delivered at that moment can change their mind, and motivate the student to keep going in the course. Additionally, for cases where the coursework proves to be too much for the student, this drop form should provide a more flexible option of lowering course load (for example, by taking one MIT course in the yearlong as opposed to two courses), instead of completely dropping the course. Overall, the function of this drop form (beside a purely administrative one) is to make the best effort to keep the student involved in the ULTA yearlong and in contact with the team.

Appendix: Tables

Table 1. Recommendation for OCW courses to offer at ULTA.

<p><i>Introductory MIT courses:</i> 3.091 Introduction to Solid State Chemistry 6.0001 Introduction to Computer Science and Programming with Python 6.0002 Introduction to Computational Thinking and Data Science 6.00 Introduction to Computer Science and Programming 6.042 Mathematics for Computer Science 6.041 Probabilistic Systems Analysis and Applied Probability 6.034 Artificial Intelligence 7.016 Introductory Biology 8.01 Physics I: Classical Mechanics 9.00 Introduction to Psychology 14.01 Principles of Microeconomics 18.01 Single Variable Calculus 18.02 Multivariable Calculus 18.S191 Introduction To Computational Thinking 24.900 Introduction to Linguistics</p>	<p><i>More advanced courses:</i> 5.111 Principles of Chemical Science 6.S191 Introduction to Deep Learning 6.006 Introduction to Algorithms 6.046 Design and Analysis of Algorithms 6.036 Introduction to Machine Learning 8.02 Physics II: Electricity and Magnetism 8.03 Physics III: Vibrations and Waves 8.04 Quantum Physics I 9.13 The Human Brain 9.40 Introduction to Neural Computation 14.13 Psychology and Economics 18.S096 Topics In Mathematics With Applications In Finance 18.404 Theory of Computation 18.650 Statistics for Applications 22.01 Introduction To Nuclear Engineering And Ionizing Radiation</p>
<p><i>Short / Non-typical courses:</i> 20.219 Becoming The Next Bill Nye: Writing And Hosting The Educational Show CMS.116 Creating Video Games RES.TLL-005 How to Speak 8.20 Introduction To Special Relativity 21A.550J DV Lab: Documenting Science Through Video And New Media</p>	

Table 2. Recommended structure for the course selection form.

<p>Below is a list of characteristics and values, some of which may be important to you, some of which may be unimportant. Please select the 2 or 3 values or qualities that are most important to you. <i>Mention a (diverse) list of plausible values of interest to the student population here</i></p>
<p>In Fall 2023, we will offer support for up to five academic courses from MIT: <i>Mention 5 courses offered here – determine based on student base and mentor availability</i> Please, pick two courses from the list above that you are most interested in taking. Why are you interested in those courses? (text section)</p>
<p><i>The following section is to be repeated twice:</i></p>
<p>Course Name (dropdown box)</p>
<p>Why did you choose this course? What are your interests outside of ULTA that studying this course will contribute to? (short textbox answer)</p>
<p>What goals outside of ULTA will this course help you achieve? What will achieving those goals enable you to do? (short textbox answer)</p>
<p>How does taking this course reflect and reinforce your most important values? Write about how you can gain strength from the fact that taking this course reinforces your most important values. Focus on your thoughts and feelings, and don't worry about spelling, grammar, or how well written it is. (textbox answer)</p>
<p>Which communities outside of ULTA are you a member of or do you plan to join that are relevant to the topics studied in this course? (short textbox answer)</p>
<p><i>The following section is to be included once, at the end of the form:</i></p>
<p>Social belonging intervention TBD based on the student base.</p>

Table 3. Recommended structure for the course drop form.

<p><i>Put details on the course the student is taking.</i></p> <p>At this time we would like to remind you what you wrote on <date>: <i>Put the student's answers to the prompts from the Course selection form:</i> <i>Why did you choose this course? What are your interests outside of ULTA that studying this course will contribute to? What goals outside of ULTA will this course help you achieve? What will achieving those goals enable you to do? How does taking this course reflect and reinforce your most important values? Write about how you can gain strength from the fact that taking this course reinforces your most important values. Which communities outside of ULTA are you a member of or do you plan to join that are relevant to the topics studied in this course?</i></p>
<p><i>The following section is to be included once, at the end of the form:</i></p>
<p>I would like to (radio box)</p> <ul style="list-style-type: none">• Drop this course• Switch to a lighter course load
<p>Please tell us more about what obstacles forced you to make this decision so that we can better support you in the future. (textbox)</p>

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