

# Impact of Free-Certificate Coupons on Learner Behavior in Online Courses: Results from Two Case Studies

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## ABSTRACT

The relationship between pricing and learning behavior is an increasingly important topic in MOOC (massive open online course) research. We report on two case studies where cohorts of learners were offered coupons for free-certificates to explore price reductions might influence user behavior in MOOC-based online learning settings. In Case Study #1, we compare participation and certification rates between courses with and without coupons for free-certificates. In the courses with a free-certificate track, participants signed up for the verified certificate track at higher rates and completion rates among verified students were higher than in the paid-certificate track courses. In Case Study #2, we compare the behaviors of learners within the same courses based on whether they received access to a free-certificate track. Access to free-certificates was associated with somewhat lower certification rates, but overall certification rates remained high particularly among those who viewed the courses. These findings suggests that some other incentives, other than simply the sunk-cost of paying for a verified certificate-track, may motivate learners to complete MOOC courses.

## ACM Classification Keywords

K.3.1 Computers and education: Computer Uses in Education: Distance learning; H.1.2 Information Systems: User/Machine Systems: Human factors; J.1 Computer Applications: Administrative Data Processing: Education

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MOOCs; SPOCs; Price Elasticity; Distance Learning; Free Coupons; Learning Analytics

## INTRODUCTION

In this work, we present two online learning case studies situated within MOOC-based technologies: In the first one, we conduct an exploratory study into how coupons might influence learner behavior in courses targeted at teachers and education leader. The providers in the first case study hosted seven instances of four different courses on the edX platform in

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a three-year period. In two courses and five instances, learners could access all course materials for free, but could only earn the certificate if they upgraded to a certificate-eligible track, on the edX platform, called the verified track, and completed all course requirements (learners who did not purchase a verified track are referred to as auditors). In the other two courses (two instances), a donor sponsored an initiative to make a coupon code available to all learners to make the verified track free.

In the second case study, we examine an online professional certification program on quantum computing on MIT xPRO. These courses in the certification program have high quality content, a higher price, and target professional learners. The access to these courses is restricted to only learners who pay the course fees. However, one cohort of learners was able to access the program for free because the courses were sponsored by their employer. This group of free-certificate track eligible learners will be used as a comparison group for the rest of learners that paid for the quantum computing courses.

Our overall objective for this paper is to first compare in each of the case studies the potential effect on engagement and completion on having a cohort of students being able to obtain certificates without having to make a financial investment in the course, and then, to make some cross-case observations. The two case studies in this article both examine instances where specific cohorts of learners had access to coupons which allowed them to earn a verified certificate without investing money in the course. By comparing these learners to learners in the same or similar courses, we can estimate the extent that not paying for a certificate-eligible track changes its potency as a commitment device.

## BACKGROUND

This work builds on two ideas from economics and marketing research—elasticity and commitment devices—that have received limited attention in the literature on MOOCs and other consumer-oriented online learning experiences.

Elasticity refers to the slope of a demand curve in a basic supply/demand model. In some domains, goods are inelastic or minimally sensitive to price; demand declines slowly as price increases (e.g. gasoline). In the case of elastic demand, demand declines very rapidly as price increases (and vice versa). Studies of higher education have found that student demand for higher education is highly elastic [8, 6].

Behavioral economics researchers have also noted that financial investments can serve as commitment devices [10], where

consumers invest in a service, such as a course, in order to encourage themselves to finish the course. Paid certificates are potentially effective commitment devices; since learners have already paid for a certificate, they may be more motivated to finish the course to avoid a “sunk cost” [5]. If the cost of a certificate acts as a strong commitment device, verified-track purchases should be positively correlated with persistence among consumers, and if they are a weak commitment device, then persistence should be weakly correlated with paying for a certificate-eligible track. Research on the effect of higher education costs as commitment devices have been mixed. Although some causal studies have found that students complete college at lower rates when given scholarships [4], other studies have found no effect [7].

Although there has been extensive work in higher education, to calculate the optimum value of tuition fees [1] these ideas have not been extensively applied to MOOC courses. MOOC researchers have generally posited that purchasing entry into a certificate-eligible track substantially increases certification rates. For HarvardX and MITx courses, completion rates among participants averages 7.7%, but completion rates for verified participants average 60% [3]. However, few studies have explored whether the amount paid for a course, rather than simply having access to a verified track, is related to course engagement and completion.

## METHODOLOGY

### Context and Study Design

#### Case Study #1

In this case study, we capitalize on a philanthropic intervention in two courses that were part of a historical track record of similar course offerings without the intervention. We examine four courses that engage school leaders, including teacher leaders, librarians, principals, and system administrators. These courses are offered through the edX platform and are free for participants. The courses, given over seven instances, share a similar pedagogical structure and participant profile. All courses are targeted towards educators working in PK-12 settings. In two of the four courses (five instances), participants could upgrade to the verified certificate track for US\$49. Unlike in some MOOCs, upgrading to the verified track did not provide any additional access to content or features. However, upgrading to the verified track would allow participants to earn a verified certificate if they earned at least a 60% in the course. In the other two courses (two instances), philanthropists funded a coupon code available to all registrants to upgrade to a free verified certificate: links to access the coupon code were distributed through email messages and through the course platform.

#### Case Study #2

MIT xPRO is an independent initiative from MIT that uses Open edX software to teach private courses to professionals on topics that are emerging and have high industry appeal. Applications of Quantum Computing in MIT xPRO<sup>1</sup> (denoted from now on as QCx) is a professional certification program

<sup>1</sup><https://mitxpro.mit.edu/courses/course-v1:MITxPRO+QCx+2T2018/about>

that focuses on the core principles, business applications, and implementation of quantum computing. This program is targeting professionals, interested in learning the basis of quantum computing and how it can be applied to different contexts. The fees to take the four QCx courses were US\$3,900. If courses were taken separately, the price was US\$1,700 for each one. The four courses of the first iteration of this program took place between April 2018 and October 2018. These courses were sponsored by IBM Research, and as part of the agreement, IBM was able to provide free access to these courses to some of their employees; we describe this cohort of employees from IBM that accessed these courses for free as having participated in a free-certificate track for these courses.

#### Comparisons Across Cases

The two cases explored in this paper are extremely different in terms of course content, types of participants, and pricing strategies. However, because both courses used Open edX and thus share a similar data structure we are able to analyze the same variables within each set of courses. Additionally, the stark differences in the value of the coupons between the two case studies allow us to explore the extent that the amount of price reduction is related to changes in learner behavior. Finally, by analyzing cases in two very different contexts we can infer more generalizable principles than if we examined case studies within similar contexts

### Research Question

We investigate the following research questions:

1. How did eligibility for a free-certificate track affect the percentage of students who verified for the courses (Case Study #1 only) and the demographics of those participants?
2. How did eligibility for a free-certificate track affect participants' intentions to participate in the course, as reported on entrance surveys?
3. Accounting for differences in course content and length, did free-certificate track participants have different number of events, videos watched, days participated in the course, course grades, and certification rates?

### Data and Methods

We downloaded the standard edX data packages and log files<sup>2</sup>. Since both platforms run on Open edX learning environment, we were able to use *edx2bigquery* data processing scripts [9] to arrange the data in a person-course dataset that contains a number of columns regarding course activity and completion of the learner with the course, and the modal country of the user (based on their IP address). Additionally, we merged in participant gender, date of birth, and level of education which are collected by edX when participants register for the platform. To account for different content and lengths of the courses in the study, we calculated z-scores for each of the course activities within each individual course. This method allows for comparisons across courses without having to make the assumption that distributions are equivalent across courses.

<sup>2</sup><https://edx.readthedocs.io/projects/devdata/en/latest/>

Both courses administered entrance surveys to all course participants. For this analysis, we focus on survey questions pertaining to their intentions to participate in the course, as reported in the entrance surveys. Although participants' intentions have historically not been strong predictors of MOOC course participation [2], we chose to analyze intentions because we were interested in comparing participants' mindsets on the outset of the course to detect possible differences in motivation. Response rates for the entrance surveys were 60% among verified track participants in Case Study #1 and 51% across all learners in Case Study #2.

For Case Study #1, we compared the within-course standardized difference between verified participants and auditors (e.g., participants who did not sign up for the verified track) in the four paid-certificate track courses to the same difference in the course with the free-certificate track coupons controlling for gender, age, level of education, and whether the user was in the United States. For Case Study #2, we used a similar regression to compare the within-course standardized differences in activity between free- and paid-certificate track participants.

### Limitations

Our case studies are observational. Participants were not randomly assigned to receive coupons for free-certificate tracks. As a result, participants in the free-certificate track condition in both case studies may have come in the courses with systematically different backgrounds and motivations than those in the paid-certificate track condition. Although we controlled for demographic differences in our statistical models the two groups possibly differed on other unobserved characteristics. Our study provides cross-sectional evidence that can motivate further work that supports more robust causal inferences.

## RESULTS

### Case Study #1 Results

In Case Study #1, offering coupons for free-certificate track eligibility was associated with more students signing up for a verified certificate. In the paid-certificate track courses, 4% of participants paid for the verified track which allowed them to earn a verified certificate – this is similar to the overall percentage of verified users in MITx and HarvardX courses [3]. In the free-certificate track courses the percentage of users who signed up for the verified track was 16%—more than triple the rate of the paid-certificate track courses. Verified participants in the free-certificate track courses were more likely to from the United States ( $p < 0.001$ ) but there were no other significant differences by age, gender, or level of education.

Based on survey responses, learners in both sets of courses had relatively similar intentions to participate in the course. Verified learners in the free-certificate track course were similarly likely to report that they intended to complete all assessments (76% for paid-certificate track vs 75% for free-certificate track), while auditors in both sets of courses were less likely to report that intended to complete most or all assessments (53% for paid certificate track vs 44% for free-certificate track). Using an ANOVA model, we found significant differences between groups of learners ( $p < 0.001$ ) with post-hoc

tests indicating significant differences between the verified learners and auditors in both the paid- and free-certificate track courses ( $p < 0.001$ ), but not between the two groups of verified learners ( $p > 0.1$ )

From our regression analysis, we found that verified students had higher levels of engagement in the courses than auditors. Compared with auditors, verified students recorded 1.85 standard deviation more events ( $p < 0.001$ ), watched 1.61 standard deviation more videos ( $p < 0.001$ ), and spent 1.75 standard deviation more days in the course ( $p < 0.001$ ). Verified students also had course grades that were 1.26 standard deviation higher than auditors ( $p < 0.001$ ).

Additionally, verified students in the free-certificate track course continued to have higher levels of course engagement than students who audited the course, but the difference between these two groups was significantly smaller in the free-certificate track course. On average, the difference between verified and auditing students was 0.59 to 0.44 standard deviations lower in the free-certificate track course than in the paid-certificate track courses ( $p < 0.001$ ). However, the differences course grades were higher in the free-certificate track course and in the paid-certificate track courses (0.16 standard deviations) ( $p < 0.01$ ). The full regression tables for both case studies are available upon request.

Course completion rates was higher in the free-certificate track courses than in the paid-certificate track courses. In the paid-certificate track courses, 38% of verified students passed the course and earned a certificate compared while 51% earned a certificate in the free-certificate track course ( $p < 0.001$ ).

### Case Study #2 Results

Participants who were eligible for a free-certificate track were more likely to be female, have an advanced degree (particularly a doctoral degree), be over the age of 50, ( $p < 0.001$ ) and were slightly more likely to be in the United States, although this difference was not statistically significant ( $p > 0.1$ ).

On entrance surveys, learners in the free-certificate track were slightly less likely than those who in the paid-certificate track to say that “earning a certificate” was an important motivation for completing the course ( $p < 0.1$ ). However, for many participants in the free-certificate track, earning a certificate was an important motivator; 37% said that earning a certificate was a “very” or “extremely” that important motivation for them in participating in the QCx courses compared to 48% of those in the paid-certificate track.

Based on our regression analysis, learners in the free-certificate track had, on average, 0.44 standard deviation fewer events than students in the paid-certificate track ( $p < 0.05$ ). Free-certificate track students also had watched fewer videos (0.25 standard deviations) and spent fewer days in the course (0.20 standard deviations), although the differences were not statistically significant ( $p > 0.1$ ). There was no meaningful difference in course grades between students in the two tracks (0.05 standard deviations,  $p > 0.1$ ). Although completion rates were generally high, students in the free-certificate track had lower completion rates (50%) than those who paid for a certificate (77%,  $p < 0.001$ ). However, when restrict this to

only learners who viewed the course the gap is much smaller (68% to 77%,  $p < 0.05$ ),

## CONCLUSIONS

This work reports on a pair of online learning case studies, where students had the opportunity to earn a free certificate, to explore how the price of a certificate was associated with changes in student enrollment and activity within the course. Our findings suggest that consumers of MOOC-based technologies are price-sensitive; a reduction of only US\$49 in cost was linked to a tripling of verified registration in Case Study #1. Additionally in Case Study #2, when the cost of the course was US\$3900, more women, students over 50, and students in the US, participated in the free-certificate track than in the paid-certificate track. This suggests that these participants may be particularly price sensitive and thus more likely to sign-up for a certificate track if they do not need to pay for it.

Our findings also suggest that the opportunity to earn a certificate, whether or not the learner invests in the course, may serve as its own commitment device. Although, course participation—in terms of actions taken, videos watched, and number of days in the course—was lower among students in the free-certificate track, in both case studies participation and completion among verified students in the free-certificate track was very high. We might thus view the process of signing up for a verified certificate and financial investment in the course as two separate mechanisms for demonstrating or encouraging commitment within an online course. The fact that we observed similar trends in both case studies, despite the vast differences in setting, suggests that similar underlying mechanisms may be at play. One possibility may be that learners view free certificates as scarce resource and even in the absence of paying for the certificate, learners may not want to miss out on the opportunity cost to earn a free certificate.

The exploratory evidence suggests that additional efforts to design rigorous experiments in coupon use may be promising. Researchers should identify how consumers of MOOC-based technologies respond to different incentives across different courses and contexts. Experimental designs could randomly assign registrants to receive or not receive a coupon by email or in the courseware or a more sophisticated design that randomized at the course level across a set of courses. However, such designs may need to consider ways to minimize the disruption of having only some students in the course receive a subsidized certificate.

As governments and workforce development systems turn to online learning to support lifelong learners, better understand-

ings of how consumers of MOOC-based technologies respond to different financial incentives can help organizations effectively target resources to optimize educational attainment.

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