
Expert Evaluation of 300 Projects per Day

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Abstract

In October 2014, one-time MOOC developer Udacity completed its transition from primarily producing massive, open online courses to producing job-focused, project-based microcredentials called "Nanodegree" programs. With this transition came a challenge: whereas MOOCs focus on automated assessment and peer-to-peer grading, project-based microcredentials would only be feasible with expert evaluation. With dreams of enrolling tens of thousands of students at a time, the major obstacle became project evaluation. To address this, Udacity developed a system for hiring external experts as project reviewers. A year later, this system has supported project evaluation on a massive scale: 61,000 projects have been evaluated in 12 months, with 50% evaluated within 2.5 hours (and 88% within 24 hours) of submission. More importantly, students rate the feedback they receive very highly at 4.8/5.0. In this paper, we discuss the structure of the project review system, including the nature of the projects, the structure of the feedback, and the data described above.

Author Keywords

Online education; evaluation; feedback.

ACM Classification Keywords

K.3.2. Computer and Information Science Education.

Evaluation Metrics

Quantity: On average, how many projects are reviewed each day? In the week preceding this analysis, 432 projects were reviewed per day, and 357 projects were reviewed per day for the previous four weeks.

Turnaround Time: On average, how long does a student have to wait to receive their feedback? The median turnaround time the previous seven days was 138 minutes, with 95% of projects returned to students within 24 hours.

Student Satisfaction: Students rate their satisfaction with the reviews they receive on a scale of 1 to 5. Are they satisfied with the feedback? The average rating received is 4.8/5.0, with roughly 29% of students rating their level of satisfaction.

Introduction

In October 2014, one-time MOOC developer Udacity launched its first collection of Nanodegree programs. Nanodegree programs were set apart from many other online offerings by their strong emphasis on projects. A Nanodegree program was primarily a collection of projects, with MOOC-based material to support the projects. Projects took on various forms, from web sites to Android applications to data reports [1].

Soon, a challenge emerged: assessment. The projects were too open-ended for automated evaluation, but they strived for a level of expertise that was believed to be impossible from peer review alone. Expert feedback was needed. But with programs quickly scaling up to hundreds of submissions a day, how would expert evaluation be possible?

To address this issue, Udacity set about recruiting freelance project reviewers. Project reviewers are paid per project, creating a gig economy surrounding project evaluation. After a year, the results have been striking: thousands of projects have been evaluated with rapid turn-around times and high student satisfaction.

In this paper, we present the structure of this system and evaluate its success across three metrics: number of projects handled, turn-around time, and student satisfaction. We close by noting a collection of pedagogical benefits present in this system.

Program Structure

Nanodegree programs are project-based vocational curricula aiming to prepare students for the job title given in the Nanodegree program's name. Each Nanodegree program is built around a series of projects. Each project is open-ended, allowing students significant leeway to decide how to approach the

problem. Students are supplied a rubric for project evaluation, and are subsequently evaluated on their success according to the rubric. The ultimate goal of the projects is to give the student a strong portfolio of past work in the chosen field.

Each student is given a set of customized due dates based on their enrollment date. If a student misses a due date, their subsequent due dates are simply shifted backwards; there is no other penalty for missing a due date. Upon submission, projects are evaluated by an expert and returned to the student with written feedback. If the project meets expectations, the student receives credit for completing it; if not, the student may try again.

Each Nanodegree program is supported by Udacity's courseware, often available separately as independent MOOCs. Students are not required to watch these courses; if a student enters the program with sufficient knowledge to execute a project or would prefer to learn from another source, they may.

Project Review

The foundation for this system is the ability to rapidly review and return projects to students. There are over 10,000 students enrolled in Nanodegree programs, and thus, hundreds of projects are submitted each day. To address this, Udacity leverages a group of hundreds of individual project reviewers.

Project Reviewers

Initially, project reviewers were Udacity employees, but as the programs have scaled up, more and more Nanodegree graduates have been recruited to join Udacity's project review workforce. To become a project reviewer, the student must first complete the Nanodegree containing the project they want to review.

Then, they must complete the Udacity Code Reviewer course [6], as well as some additional project- or program-specific training. After demonstrating success in evaluating some sample projects, the reviewer may be selected as a full reviewer. Reviewers are paid between \$5 and \$50 per project reviewed, and they themselves regularly receive student feedback.

Project Submission And Assessment

As they progress through the Nanodegree program of their choice, students complete and submit projects. In addition to the code, papers, analyses, or other deliverables demanded by the project, students may also submit notes requesting certain types of feedback. Upon submission, the project is added to the list of projects awaiting evaluation, and any reviewer for that project may claim it and begin reviewing.

While reviewing, the reviewer has access to a number of resources to support their evaluation. They see the notes left by the student, as well as the history of project submission so they can check the feedback the student has received in the past and observe the progress the student has made. The reviewer then evaluates the project based on the rubric, supplying written feedback as well as a pass/fail ruling on each rubric category. Upon completion, this feedback is immediately returned to the student, at which point the student may optionally evaluate the feedback they received on a five-point scale and leave written feedback for the project reviewer.

Evaluation Metrics

This paper has thus far summarized the project review system used at Udacity for evaluating student work. There are a number of ways we can evaluate the success of this system. The left sidebar summarizes

three: (a) its success at evaluating a large number of projects, (b) the average turnaround time between submission and evaluation, and (c) students' self-reported satisfaction with the evaluations they receive.

Table 1 summarizes the evaluation of the project review system for two time periods for which complete data is available. Due to these metrics, we consider the project review system implemented by Udacity to be successful at scaling up expert evaluation of student assignments to hundreds of assignments every day.

Pedagogical Benefits

These metrics evaluate whether or not the system employed here was successful at scaling up expert evaluation of projects. We speculate that there are pedagogical benefits in this project review system. In comparison to traditional academic settings, we observe three major benefits to the project evaluation model presented here: the rapidness of feedback, the emphasis on revision, and the flexibility of the deadlines. The combination of these three things results in evaluation being almost entirely framed as formative rather than summative assessment [3].

First, from the perspective of traditional higher education, it is often a struggle to return assignments quickly; a one-week turn-around time is anecdotally considered good. The model presented here, however, returns 95% of projects within 24 hours. Less than 1% of projects have to wait a week for feedback. Rapid feedback gives students more opportunity to iterate over their projects and learn from their reviews.

Second and relatedly, iteration and improvement are often absent in traditional higher education. This is the traditional grading model: each assignment is given a grade, and those grades together form the final score

	Last 7 days	Last 28 days
Projects Reviewed per Day	432	357
Median Turnaround Time (minutes)	138	168
% Returned within 24 Hours	95%	91%
Student Satisfaction	4.8/5.0	4.8/5.0

Table 1: Statistics for projects evaluated in the last 4 weeks and 7 days, respectively. In each case, the statistics are through October 27th, 2015.

in the class. In the Nanodegree model, however, if a project submission does not meet specifications, it is returned to the student for revision and resubmission. There is no Nanodegree equivalent of 'failing' a project: if a student 'fails' a project, that simply means they must try again. This puts puts formative assessment front and center in the evaluation process

One of the reasons why assignment submission is final in traditional higher education is the need for immovable due dates: the semester must end on a certain day, and the student must have a grade for the class by that day. For this reason, the third major pedagogical benefit of the model used in the Nanodegree programs is the flexible due dates. As with the emphasis on revision, a student in a Nanodegree program can never 'fail' an assignment. This retains the motivation provided by due dates [5] while removing their finality.

Conclusion

In scaling higher education, whether it be through MOOCs or simply through more accessible online programs, assessment remains one of the most significant considerations. In its Nanodegree programs, Udacity decided that expert evaluation was necessary for the type of outcomes it strived to achieve, and thus it set about finding ways to integrate expert evaluations into a large program.

The result: despite the submission of hundreds of projects every day, the project review system gets 50% of students feedback within 2.5 hours and 95% of students feedback within 24 hours, while maintaining a high student satisfaction rate with the feedback and creating other pedagogical benefits. Perhaps more significantly, there remains a significant wait list of

students wanting to become project reviewers; it is feasible that this same model could easily be extended to tens of thousands of submissions a week.

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