Delft University of Technology

# TU Delft Online Learning Research Working Paper #4

DelftX MOOC Course Report TW3421x Introduction to Credit Risk Management

TU Delft


The report is to give more of an insight in the background, the implementation of the course and the results. The purpose is to provide useful information (and clean data) to the team of developers and teachers and to others to support their aspiration to improve online education. A more in depth analysis of the first five DelftX MOOCs can be found in the 'Working Paper DelftX MOOCs, the first year (2013-2014)'.

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**Course report - TW3421x Introduction to Credit Risk Management**

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# Summary

| | |
|---|---|
| **Name course** | TW3421x Introduction to Credit Risk Management |
| **Date** | April 15th - June 30rd 2014, 7 weeks course duration |
| **Faculty** | Electrical Engineering, Mathematics and Computer Science (EEMCS) |
| **Teachers** | Dr. Pasquale Cirillo |
| **# of students** | 20925 registered and 709 certified completers |
| **Level and prerequisite** | The course is an evolution of the WI3421TU Risk Management course, a compulsory course of the Minor Finance at TU Delft.<br>Requires understanding of such concepts as<br>• Calculus: derivatives, integrals, intuition of what a differential equation.<br>• Statistics and Probability: mean, variance, standard deviation, quantile, frequency, expected value, conditional probability, common discrete distributions (Bernoulli, Binomial, Poisson) and common continuous distributions (Normal/Gaussian, lognormal);<br>• Finance: basic vocabulary, e.g. interest rate, mortgage, loan, bond, etc. |
| **Course resources** | Video lectures, comprehension exercises, convergent assignments, R-based tasks accompanied by R-tutorials and exemplary datasets; readings and interviews presenting divergent views on the topics, interviews with practitioners. |
| **Special features** | DIY MOOC, i.e. many resources were self-made; interviews with practitioners, special prizes, effective content-related learning support materials, democratic selection of last week's content, gentle balance between group-level and individualized feedback. |
| **Expected workload** | Unspecified |

The Credit MOOC (CRMOOC) was a highly structured course in the area of applied non-life soft discipline. An important characteristic was the student-centered approach with frequent asynchronous student-teacher interactions. There was a significant number of supporting materials easing students way into understanding the core course content. The weekly course structure had a conventional format of short videos (under 10 min), few unassessed close-ended questions testing general comprehension, and extra reading or video resources reaching beyond the basics to present the diversity of opinions around the issue at the heart of the module.

The highly structured instructionist principles with objectives and an emphasis on learning support with for example the use of twitter for addressing urgent needs. The complex financial concepts were recorded using simple everyday materials, in a playful and creative way (e.g. see Figure 2). By using those in combination with the use of color, simple language, and an overall humble attitude, the course as a whole has a unique, dynamic and personable feel to it.

Most students rated the course as good to very good (84%) with a nice balance between the lectures, exercises, feedback and assessments and would do another course given by the same teachers team.

# 1. Introduction

The course TW3421x Credit Risk Management from the Faculty Electrical Engineering, Mathematics and Computer Science of the Delft University of Technology ran for 7 weeks from April 15 to June 30, 2014. In total 20925 participants showed interest by enrolling in the course, and 709 participants completed the course with the certificate of completion. The purpose of the course was to introduce basic concepts in credit risk management, as well as premises upon which these concepts are built in both conceptual and practical senses.

This report contains information about the background, the implementation of the course and the results with the purpose to add to the knowledge base of MOOC environments. The information in this report has been collected from different sources like edX subscription data, edX platform, edX student data, including the use of the forum. Using a pre- and a post-course survey made it possible to collect qualitative information on issues like expectations, motivation, prior knowledge level, and relevance and correlate the outcome with other data. In addition the teacher-developer was interviewed to acquire more insight in his experiences and perceptions.

The main purpose of the evaluation was to provide useful information, as well as ready-to-use data, to the teacher-developer and other teams involved in open and online education to improve the design and facilitation of subsequent online courses. This effort was organized by the O2E research team (Open and Online Education) from the TU Delft, in close collaboration with researchers from the University of Southern Australia.

# 2. Course Design and Pedagogy

Credit Risk Management MOOC (CRMOOC) was a university bachelor-level course within the domain of Finance, designed and delivered allowing for higher student autonomy with frequent teacher-student interaction. This section evaluates course activities in relation to pedagogy, addressing the balance of resources used, explaining assessment design, forum moderation strategy, supporting materials, and other aspects that shed light unto how this course was taught. The analysis was conducted drawing on several approaches to analysing MOOC pedagogies (Margaryan, Bianco, & Littlejohn, 2014; Swan, Bogle, Day, Prooyen, & Richardson, 2014; Toven-Lindsey, Rhoades, & Berdan Lozano, 2014; Weller, 2014).

**2.1 Design, Learning Resources and Workload**

The CRMOOC was designed as a highly structured course in the area of applied non-life soft discipline. Its aim was to provide introduction to credit risk through such themes as credit risk, value at risk, default probabilities and stress testing. Weekly course structure followed a conventional format of short videos (under 10 min), few unassessed close-ended questions testing general comprehension, and extra reading or video resources reaching beyond the basics to present the diversity of opinions around the issue at the heart of the module. CRMOOC made good use of such instructionist principles as setting objectives and summarizing content. For instance, any video or text would be preceded by a fairly lengthy explanatory text, clearly stating the reason for introducing it, as well as the expected outcomes. Moreover, simple non-jargon language would be used, and keywords would be colour-coded, making the sign-posting of learning resources learner-friendly. Additionally, each module would end with a short summary video, summarizing the main content for the week.

Average workload spent on the course, as reported by completing learners, was 6,5 hours weekly. The total amount of obligatory lectures was 4,7 hours, which equals to about 35 minutes of recorded content every week. Occasionally extra video debates on the relevant topics were suggested among additional resources. Each week had about 10-14 short exercises to accomplish, accompanied by additional readings and R-based calculations, requiring figuring out how to apply software for the newbies.

The distribution of learning resources in CRMOOC is represented in Graph 1. It can be seen that although course's content still comprises most of the Learning Resources, another large segment is dedicated to so-called Learning support. In the analysis of resources, we distinguished between supporting materials labelled organizational support, such as answer sheets, formula sheets, set-up reminders, friendly syllabi, etc, and the materials labeled learning support - that connect parts of the content, simplify, paraphrase and summarize content presented in the content-part of the resources. Learning resources in Graph 1 do not include the use of social media, although account for the centralized edX forum discussions. Therefore, it should be noted that CRMOOC team was successful in integrating course twitter account for addressing urgent needs of the learner in a similar way that they did on the actual course forum. Finally, CRMOOC also included practitioner-interviews, and introduced how to use R-software to perform most of the course's calculations in a way that was geared towards newbies in coding.

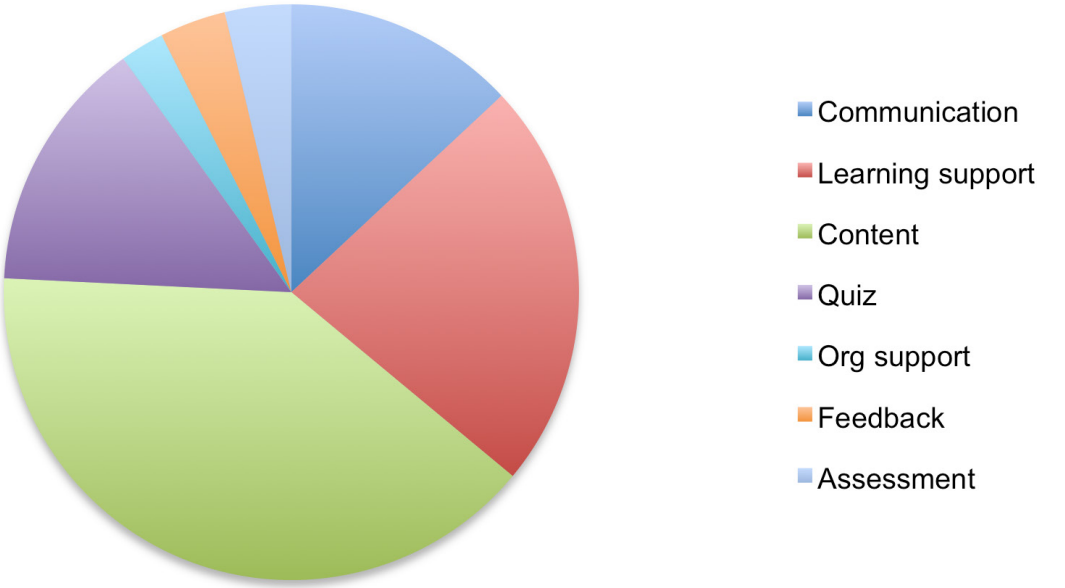


**Figure 1. Learning Resources in Credit Risk Management**

Special attention should be paid to the overall attitude to the production of learning resources in the course. Dr. Cirillo has attempted what could be called a Do-It-Yourself approach to producing course videos. Most of them were recorded in his office, some on the so-called Sofa space, where he provided group-level feedback weekly responding to general student questions. Complex financial concepts were recorded using simple everyday materials, in a playful and creative way (e.g see Image 1). By using those, as well as the use of color, simple language, and overall humble attitude, the course as a whole has a unique, dynamic and personable feel to it.


**Figure 2. Examples of DIY Lectures in CRMOOC**

### 2.2 Pedagogical Decisions

CRMOOC was a student-centered course with frequent asynchronous student-teacher interactions. All graded exams and assignments were released without a strict deadline, allowing students to deal with them in their own pace. Moreover, the course facilitator made a choice to have students vote on the content for one of the weeks of the course, which also signifies higher student autonomy and learner-centeredness. Additionally, as mentioned before, the course had a significant number of supporting materials easing students' way into understanding the core course content.

Assignments mostly tested declarative knowledge, such as the application of formulas or rules towards well-structured real life problems. Although prerequisites of the course, and weekly objectives were clearly specified, overall course objectives were not clearly stated and easily found. It is fair to say though that the

instructor has thoroughly addressed students expectations about the course content, explaining through the forum discussions what this course will not do and why.

No emphasis was placed on collaborative learning. Social media was used well for reasons extending beyond communicating course's news. Most communication occurred through the edX forum. Q&A forums for the course were limited, and structurally not integrated with the course's resources, such as videos, readings, or tasks. The forum has two sub-threads weekly with questions for fellow students and questions for the instructor. Individualized feedback from the course facilitator was very high, 237 posts (which is three times higher than made by the most active student); group-level feedback was delivered weekly through the Sofa video.

Individual differences of the students were accommodated through the range of materials. The introduction of R-software was of special interest here. Using R was new to many students, and similarly to other courses, CRMOOC offered tutorials that showed how to solve problems. What was distinct about R-integration within this course, was that there was no focus on the elegance of coding syntax, approaching R as a tool that participants can use to help them make calculations faster.

Overall, the course had a dynamic feel to it. Although peer-to-peer interaction on the forum was relatively low, there was a strong social presence of the teacher and his team, through news, adjustments and additions. To improve the course, the team may consider a) to provide subtitles for practitioners interviews; b) introduce more than one attempt for submission of the exercises; c) reconsider the way stop-motion animations were used to support some of the lectures.

**2.3 Assessment**

In order to receive a certificate of completion, students had to receive a grade of 50% or more. The grade was derived by two major parts: 80% of the grade were split between two exams (mid-course and final), and 20% of the grade were given for four homework assignments, the worst out of which was automatically discarded by the system, allowing students to receive better grades. The first assessed homework was introduced during week 3. The deadline for all assignments and exams was June 30, at the very end of the course, giving students complete autonomy in their decisions as to when to engage in learning activities. Figure 3 illustrates how many homework tasks were equal to a smaller ratio of the final grade, and few exam tasks had heavier value for the final grade.

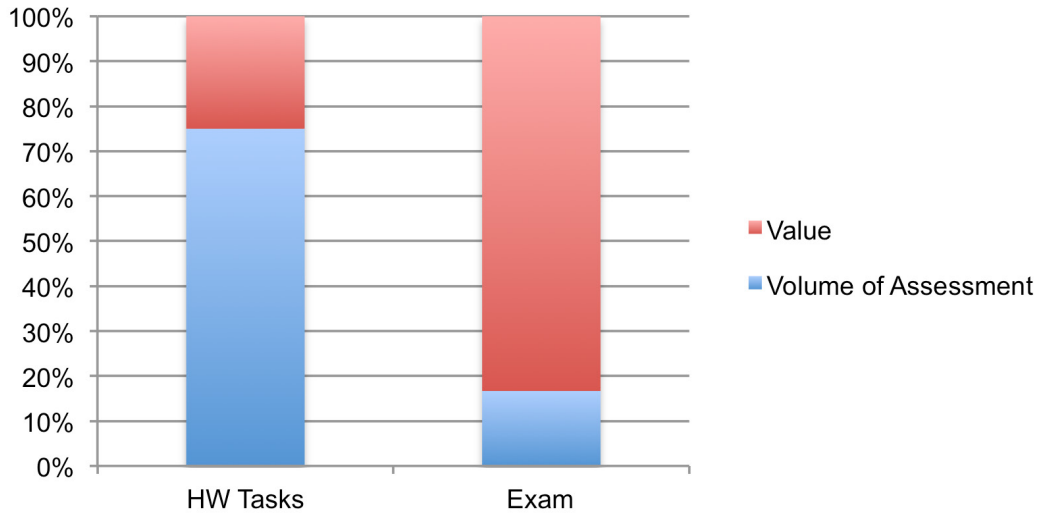


**Figure 3. Representation of amount of assessed tasks and their value towards the final grade.**

# 3. Student-related Demographics

This sub-section elaborates on the basic demographics of registered students and those who received a certificate of completion at the end of the course, in relation to their age, gender, cultural group, previous background, professional relation to the subject, educational level, and intention for enrollment. Detailed graphs related to this information are to be found in Appendix 1.

### 3.1 Registered Students

20375 students registered to learn about the Credit Risk Management. 68% of the registered students were male. Over 70% of the registered participants were 19-40 (27% under 25 years old; 23% in their late twenties; 23% in their thirties). The largest cultural group registered for the course was representatives from the English-speaking countries (26%), followed by participants from South East Asia (almost 20%) , Latin America (9,8%) and Eastern Europe (9,3%). Out of those who reported their background, 62% of registrants said that their background is related to the content of the course, and half of the registrants stated that their occupation is related to this course. Around 37% of registered student had bachelor's level education, and around 34% had master's level education. Over 12% of the registrants had high school level education. About half of the registrants stated having no previous background in the topic, around 43% reported having the same level of content understanding as they expected from the course, and 7% believed that their level of knowledge in the topic is higher than the one, at which the course was delivered.

### 3.2 Students Receiving Certificate of Completion

709 students received a grade higher than 50%, and thus were awarded a certificate of completion. 76% of those completing students were male. Similarly to the group of registrants, over 60% of the students completing the course with the certificate were within 19-40 years old. An overwhelming number of students with master's degree (44%) were among completers, while students with bachelor level educational background made up almost 30% of the completing group. Learners with English-speaking background (19,8%), Eastern European background (14%) and South East Asian (14%) background make up about 50% of the completing group. who received certificates said that their background was related to the course content; however the occupation of approximately half of the group was not related to the topic. The implication of such demographics may be that students with the degree related to finance, or economics, possibly working in a financial institution but not having specific background in credit risk management, were interested in improving their employability by taking the course. Course's suitability to those without any background in the subject also is demonstrated by the fact that in the completing group similar amount of people indicated having no background in the subject, as having background in the subject that corresponds to the level at which the course is taught.

### 3.3 Intentions for Enrollment

85% of the students who filled in a pre-course survey (around 10% of all registered), were taking the course to enhance their career. Overall the following 5 reasons were named as main motivating factors for enrollment:

1) I want to increase my knowledge and skills (90%)
2) Because I find the topic interesting (62%)
3) To challenge myself (61%)
4) To improve my employability and career prospects (57%)
5) I am working towards getting a certificate of completion for the course (43%)

Of the registrants 3% was interested because they were teaching the topic, 9% were interested as it was related to their studies, 7% were considering becoming students at Delft University.

# 4. Retention and formal performance

Over 20 000 students registered for the course. However, only 1171 attempted to complete any activity that would lead to the receival of the certificate of completion. Clearly, some of these students only samples the assignments, scoring just under ten percent for the grades. Figure 4 below indicates that out of 1004 participants who submitted the first homework assignment given out to students during Week 3, 798 people scored more than 50% on it. Similarly, for example during mid-term exam in Week 5, 999 participants attempted the exam (or possibly just sampled some tasks), and 859 scored more than 50%. All the assessed activities had only one submission attempt. Final exam was taken by 764 people and 614 scored higher than 50%.

Graph shows that the biggest drop in retention occurred after the Midterm exam. Additional analysis of time when the assignments were submitted is needed to position retention on a timeline, since there was not other hard deadline for all assignments, except the end of the course. However, it is clear that consequentially midterm and week 5, reportedly the most math-heavy week of the course, required strong learner support.

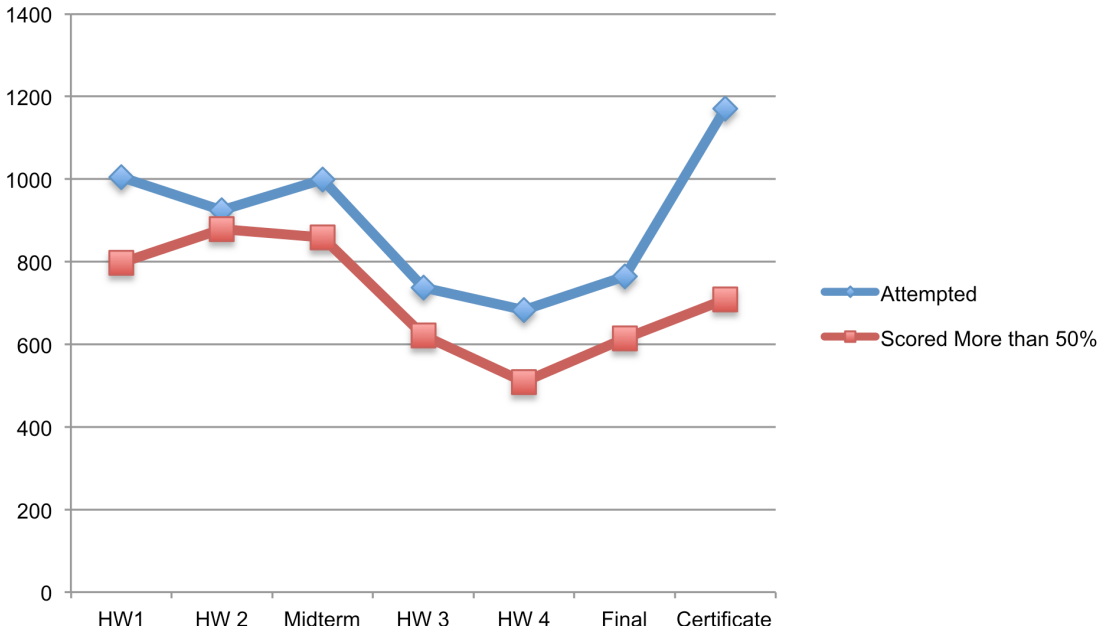


**Figure 4. Retention and engagement in assessed activities in the course.**

The passing grade was 50%. The average grade in the course was 80%, with more than half of the completing cohort scoring between 70%-90%.  Grade distribution is shown in Appendix 2.

# 5. Course forum and student interaction

The course forum was under-used. Course facilitators chose not to integrate forum spaces into the courseware, thus the forum existed separately from the learning resources, and had two main threads for each week: Questions for the teacher; and Questions for other students. It also should be noted that the course teacher produced a little under 300 comments on the forum, attempting to address most of the questions and requests. He is in fact the most active forum user, and made three times more comments than the most active student.

**Table 1. Use of edX Forum by completing students.**

| | Registered Students, % (n) | Completing Students, % (n) |
|---|---|---|
| Superposters (50-700 posts per person) | 0,01 (3) | 0,4 (3) |
| Very active (30-49 posts per person) | 0,02 (4) | 0,4 (3) |
| Active (15-29 posts per person) | 0,005 (10) | 0,8 (6) |
| Moderately active (7-14 posts per person) | 0,24 (51) | 3,2 (23) |
| Inactive (4-6 posts per person) | 0,38 (80) | 5 (36) |
| Passive (1-3 posts per person) | 2.00 (429) | 13,6 (97) |
| Did not post (0 posts) | 3.89 (814) | 14.25 (101) |
| Never logged in the forum | 93.4 (19534) | 62 (440) |

### 5.1 Student Feedback on Using the Forum

The overall satisfaction with the edX-platform was rated good (32%) to very good (63%). The importance of the forum in the course was rated more diverse with 22% considering the forum not important, 22% neither important or not important, 32% somewhat important, 17% very important and 6% extremely important. On the question of how often one did take a look or read discussions on the forum, a small majority used the forum a few times (39%) or weekly (31%). As can be seen from the interaction 58% never got in touch with another student or only once (16%) or a few times (18%). The reasons mentioned were: no need, not enough time, no idea who they were. The limited use of the forum was also reflected in the reaction on the question if the forum would make it easier to learn with others. 45% was not convinced against 54% who considered the forum helpful. The same result is reflected in the answers on the question if the forum was easy to exchange information or getting help. 52% believes the forum is 'not at all – somewhat' helpful, with 48% 'a fair bit – very much'.

### 5.2 Student Community

Since the forum was underused, there were no dominant groups on the forum as such. It can be seen from Table 1, that 17 participants made more than 15 posts each, and one of them was the course teacher. A few words will be said about the demographic features of this group. However, the description should be taken with caution, as even the dominant group was relatively active. Interestingly, 4 people in this most vocal group were from South East Asia, which is usually the least represented group of the edX forums of DelftX courses.

Otherwise, there was an equal cultural distribution among vocal participants, with 3 participants from Africa, 3 from English-speaking cultures, 3 from Germanic cultures, and 3 from Latin America. Middle Eastern cultural group and Latin European were also represented. There were no Asian students from Confucian culture participating actively in the discussions. Otherwise, the group was male-dominated, with only two women. The majority of the vocal forum users were 26-39 years old, with 2 people over 50, and 3 people under 25. $^{2}/_{3}$ of the vocal users had background related to the course's content.

We have also conducted social network analysis of the forum, as well as analysed the development of discussion threads overtime. The forum dynamics was mostly influenced by the answers given by the course teacher, who was very active. Some posts by individual students created little islands of activity, but those only lasted very short time.  The credit forum, possibly due to its limited structure, mainly served most immediate as a Q&A for the student body.

# 6. Looking back

The post-survey had 254 respondents, while 709 received a certificate of completion, so there was a 36% response assuming that only the completers filled out the survey.

From a research perspective it was interesting to see what these students were doing and what their perception was looking back after successfully finishing the course. Therefor the post-survey zoomed in on issues like confidence in handling the course, how determined they were to finish the course, the use of the online forum, social interaction, the relevance of the course, the challenges, their expectations and experiences, course quality and the question if the course inspired them to continue learning?

Most students were confident that they would master the course, understand the main concepts, be able to handle the quizzes and tests and stay focused (77%). Therefor 89% was determined to finish and to pass the course. This group also was convinced that by working hard in this course you could achieve good results (64%). Although the interactivity on the forum was modest, most students looked for additional materials (89%) or posted a comment or a question on the course discussion board (49%). Although the tendency to connect to others, share and help each other was modest (18 - 28%), the course forum was considered rather helpful (61%).

In general students felt very much that they belonged to the course (74%) and were in particular pleased by the attention they received from the teacher for their learning (82%). Since the students could decide themselves about when to do the tests and exams it was interesting to see what their planning was. Concerning their participation level 82% followed the course till the end and took the final exam and 11% did the entire course, but did not go for the certificate.

Prior knowledge made it easier for 62% to complete assignments and understand the lectures. The course was considered relevant for their professional career (59%) and believed that the level of the course will help to advance their career (54%). For 23% the course was compulsory, which is an interesting perspective, because obviously the content was considered very relevant for a large section of the completing participants.

Doing an online course has always been considered an activity that relies very much on the motivation of the individual. Therefore it is interesting to see what challenges students experience during such a course. Obviously such issues as family or professional obligations play a role (31%), having to do the course just by yourself (43%) and keeping up with the pace (16%). There were no technical issues mentioned and most participants felt they were quite able to overcome any obstacles in the course (76%).

Most students found their expectations about the course realistic (75%). 50% Indicated that the course exceeded their expectations and 42% indicated that this was exactly what they expected. They qualified the course as: awesome, excellent, efficient. demystifying, entertaining, solid, pragmatic. No wonder 84% rated the course as good to very good. The quality of the assignments and exams were rated high (well- very well 92%) as well as the balance between the lectures and exercises (good - very good 83%) and the feedback (good - very good 75%). The level of the course was seen as neither easy nor difficult by 52% and difficult by 30%. The majority considered the amount of work about right (86%), including the pace (just right 90%) and the duration (just right 82%).

Most students would recommend the course to others (89%) and would take another course given by the teacher (91%). The course increased the appreciation for the TUD (83%) and inspired students to continue studying in this field (probably 25% and absolutely 54%).

**The teacher-developer experiences and views**

From a first impression it is astonishing to see how many students can benefit from online education, although the retention rate certainly needs to be improved. The course was a solo-production on a low-cost-basis, which was challenging and time consuming. The next production should preferably be a best-cost course which allows for external experts to help out on certain issues.

The goal was to offer a first introduction to credit risk management to show that financial topics can be taught in a different way, without being boring. A lot of time was invested to offer a coherent course with a clear structure and clear expectations for which the feedback of the students was of great importance.

Concerning the evaluation it would be helpful to receive the survey materials ahead of time to allow for useful adaptation and to make the results available to the teachers, also in a raw format.

The course was very helpful to reconsider some topics and motivated a lot to reshape standard classes. Surely one can improve the quality of the materials such as video's and add animations, but that would require some assistance.

The edX platform works well, but needs to be improved: the forum on edX is not really used-friendly and therefore less useful for interaction; the possibilities for editing all aspects of the course are limited; internal links to exams and questions are poor, the instructor's dashboard needs an upgrade and edX should offer mobile apps and allow for a better integration of social networks in the platform.

This solo-production was time consuming (1.5 months full time), but inspiring and it is hoped for a continuation of the course on a higher level (Master-).

# 7. References

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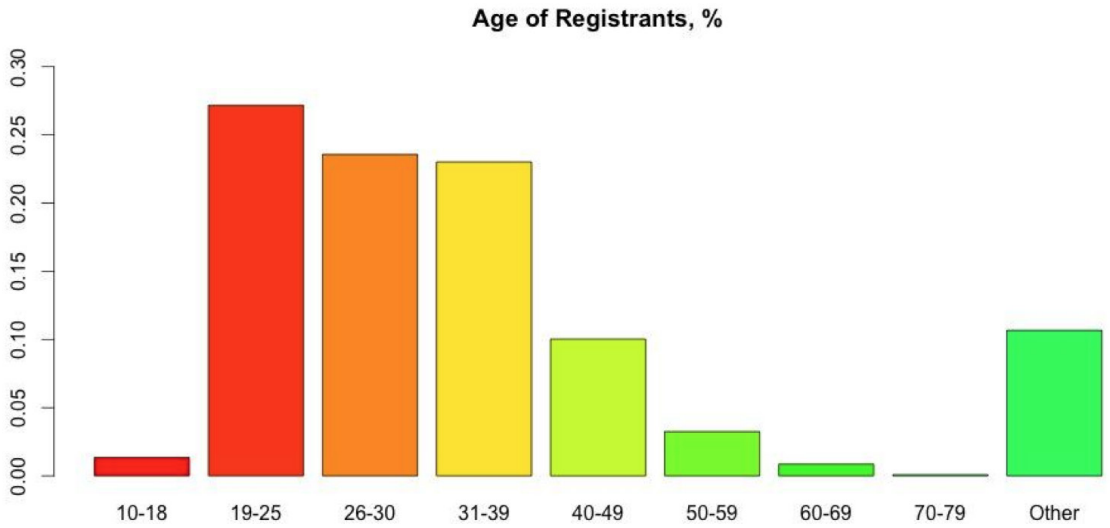
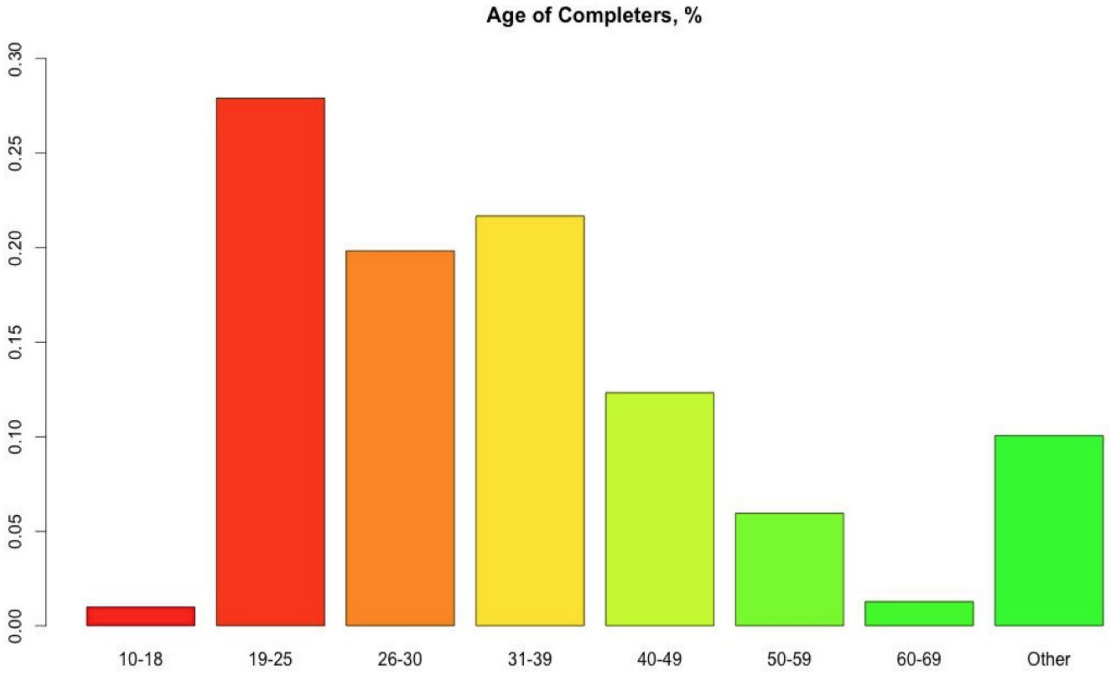
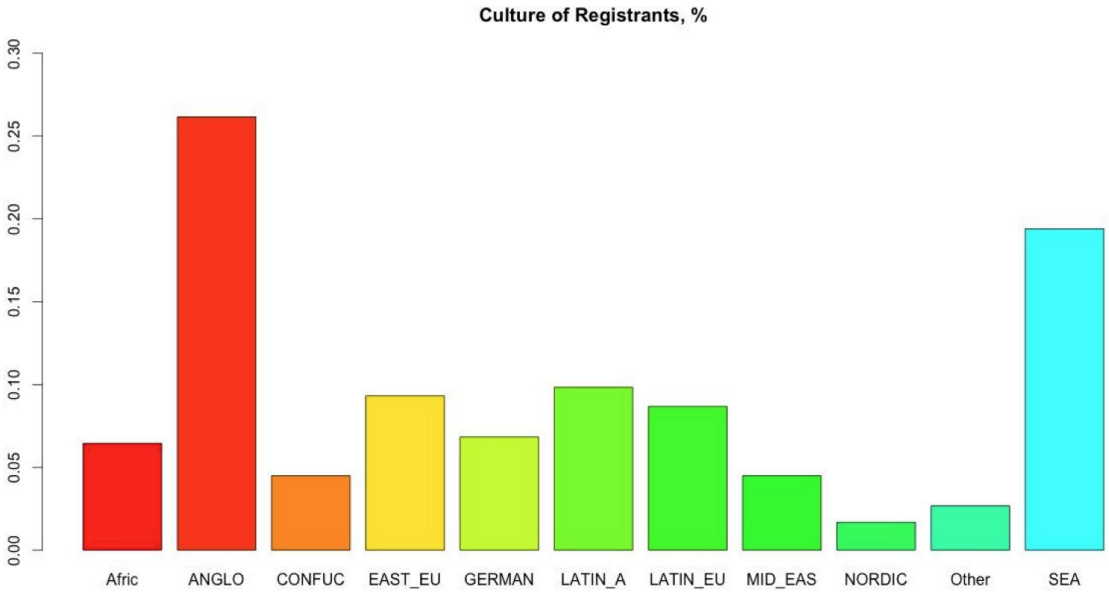
# Appendix 1. Student Demographics. Registered and competing students who received final certificate

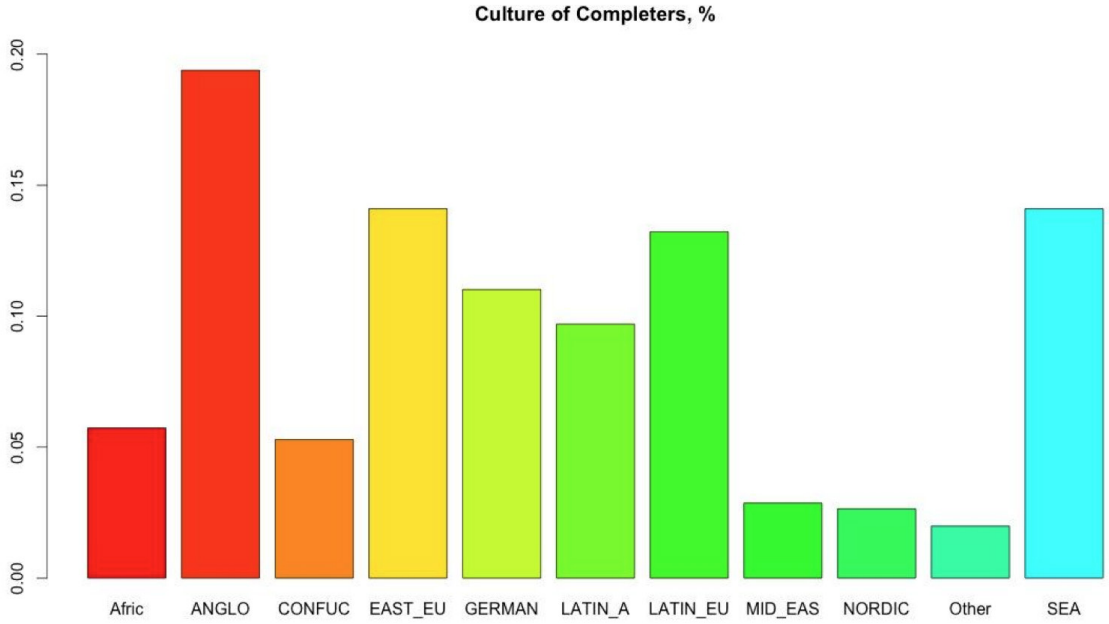
**A) Age**



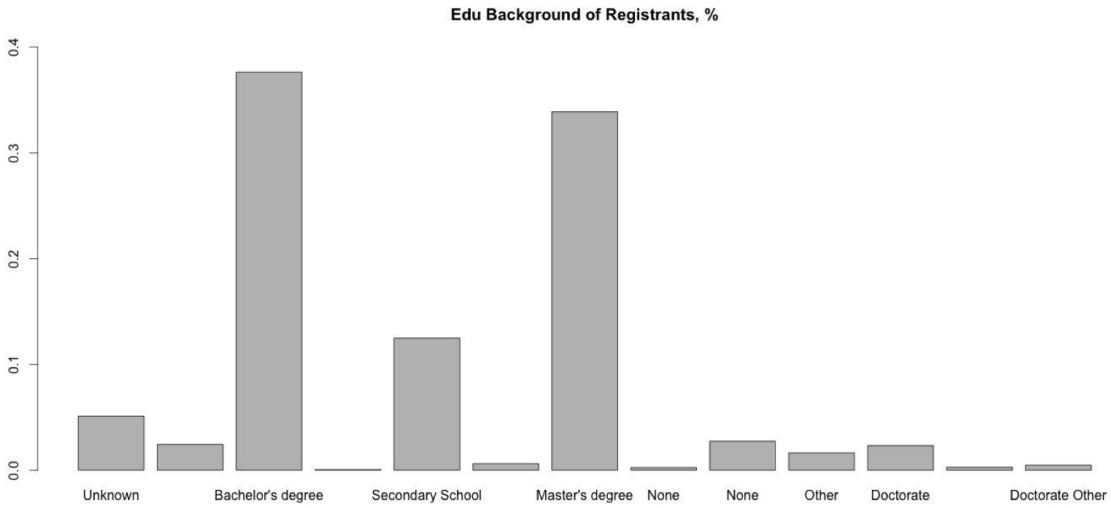



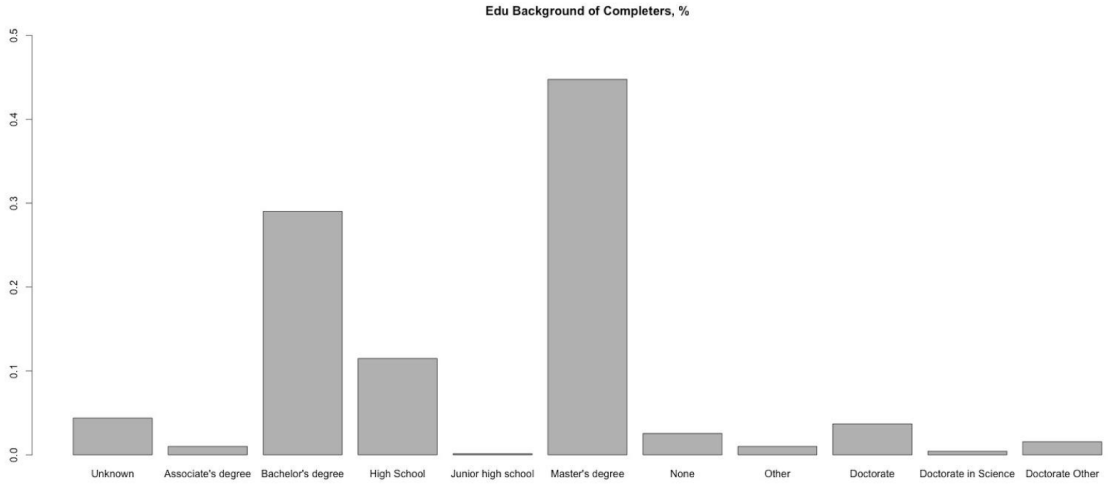
B) Cultural Background



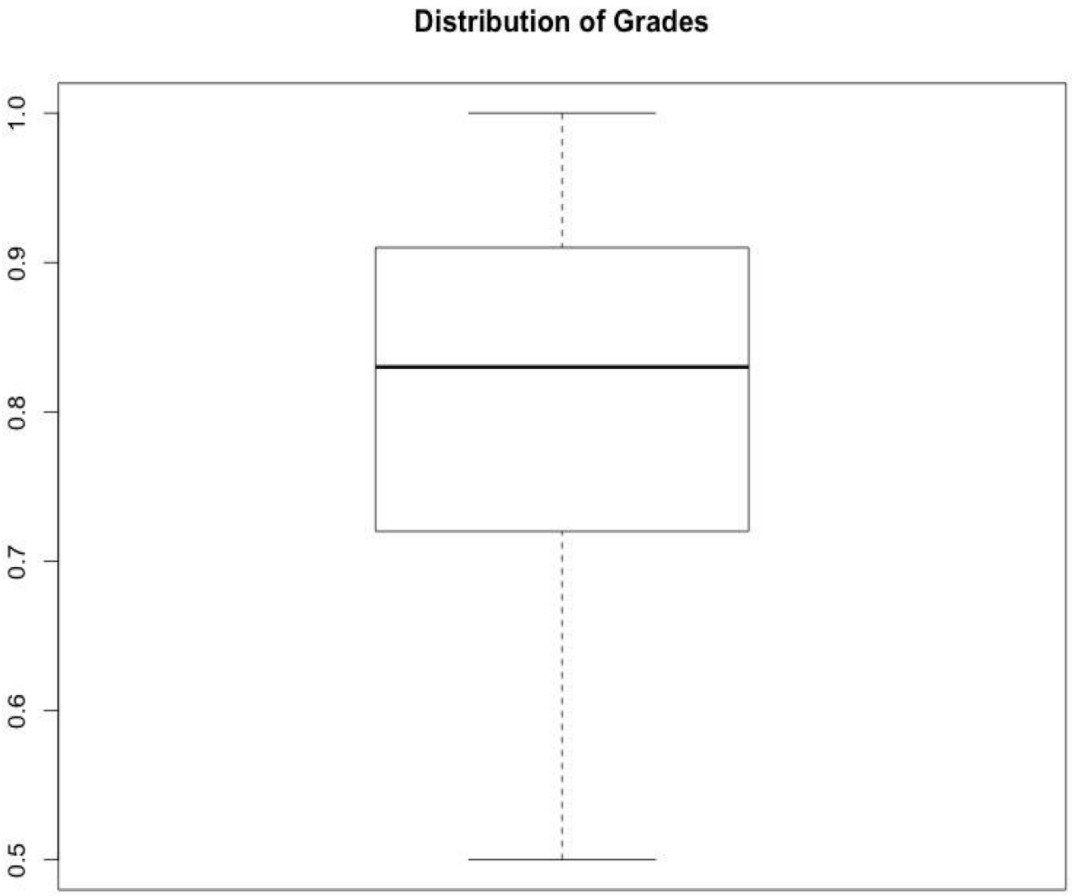



### C) Educational Background



# Appendix 2. Grade Distribution



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