

# An Experience Report on Transitioning to Blended Learning and Portfolio-assessment: a Cross-campus Course in Programming

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**Abstract**—The transition from traditional to digital teaching has led to several challenges for students and educators under the COVID-19 pandemic. Most universities are experiencing remote online delivery and assessment for the first time, which creates several issues, particularly for delivering courses efficiently and evaluating the outcomes without students compromising academic integrity. In this study, we take a closer look at a cross-campus case in delivering a programming course that switched to digital teaching due to COVID-19. We focus on the transition in assessment forms and the gradual adaptation to portfolio evaluation over two years. This form of assessment is more aligned with the constructive alignment theory, and hence contribute to increased learning outcomes as the students receive feedback along the way. Furthermore, we introduced a task where students had to reflect on the answers and solutions. This reflection note may help the teacher to better understand to which level the student has actually understood the theories and skills applied in the solution, and hence reassure that the solution is produced by the student. Observations from our data provide promising direction that it can increase learning benefits and reduce possibilities or the need for cheating and contributes to increased learning outcomes. However, this form of assessment requires a significant effort from teachers and is both time and resource consuming.

**Index Terms**—Programming, Blended learning, portfolio assessment, cross-campus, COVID-19

## I. INTRODUCTION

The physical closure of universities and university colleges on March 12, 2020, in many countries across Europe, resulting from the COVID-19 crisis, has expedited the digitization of teaching at an unprecedented rate. Typically, such a process would take 15 years, according to some estimates [1]. During any crisis, such as a pandemic, online/blended (face to face sessions mixed with online) learning could better address the academic needs of students. The usage of ICT-based technologies has transformed the entire teaching methodology

into a learner-centered pedagogy, with technological skills being the essential qualifications for both teachers/educators and learners [2].

Finding effective strategies in the online context presents several obstacles, as online evaluation necessitates a more continuing methodical approach than traditional methods [3]. When realistic scenarios are used in defining learning objectives, variances in learning styles are acknowledged, and students receive enough support in learning activities and using software, online assessment techniques are effective [4]. One of these challenges is that students may find cheating easier during exams. Reference [5] reports in their study that while nearly all students said they had never had someone else take an exam for them, they discovered that over 45% thought cheating in an online class was simple, and 30% said they would cheat if given a chance [5]. With such a backdrop, we changed the exam form from written exams with a grade scale to a home exam with a Pass/Fail grade as a temporary solution in response to the recommendation from the university. Based on the feedback obtained and the dissatisfaction of most students over the Pass/Fail examination form, we changed the assessment structure to portfolio evaluation the following year. The primary reason for student dissatisfaction is that the subjects with the grade form Pass/Fail are not included in calculating the total average grade. Eventually, this leads to limited grade accumulation to qualify for master degree programs. Therefore, many students preferred a letter-based grading policy (A-F) over the Pass/Fail examination form. We changed the assessment form to a portfolio evaluation with an A-F grade range in response to student feedback and to meet the needs of students.

Our study investigates how the switch to online/blended education impacted the use of instructional and formative

assessment methods of the education process. We report on our experiences and recommendations in connection with a programming course at the university level. The purpose of this research is to reflect on the strengths and weaknesses of the portfolio as an instructional and formative assessment method and share our experiences and findings as we shift from a written exam to a portfolio assessment.

This study is based on quantitative- and qualitative research methods where data has been collected using surveys, open-ended questionnaires and reflections notes. We look at the transition to portfolio evaluation and the perspectives of students and instructors in this case study.

## II. LITERATURE REVIEW

Historically, face-to-face instruction was the only method of instruction in which the instructor and students met physically [6]. There has been a perception that online learning could eventually replace face-to-face instruction and that this mode of education could be an economically viable option for students. This increased the number of online courses available in the mid-1990s. Despite increased efforts to expand course offerings, online education did not perform as well as predicted, as learning was primarily a solitary experience [6], [7]. Blended learning, a third teaching method, has gained widespread acceptance among lecturers and scientists. By combining the advantages of various technologies, online tools, and teaching methods, this strategy can incorporate the best of both online and face-to-face teaching. According to research, a combination of being on-campus and digitally working is optimal and can demonstrate to be significantly more effective than using only one or the other [8].

However, as schools and universities worldwide moved to an online or blended learning environment to combat COVID-19, exam cheating and academic integrity became a significant concern [9]. In our case, the COVID-19 pandemic triggered the transition to blended learning and thus opened up opportunities for a more effective form of teaching, but at the same time also opened up possibilities for students to cheat during exams. Several web proctoring systems (including virtual tools to monitor student behaviors during assessment tasks) have recently emerged on the market, addressing some of the significant issues surrounding exam cheating. They are, however, currently untested and unproven on a large scale [10].

One academic integrity strategy might be to have the students sign an academic integrity pledge. These pledges are supported by Kohlberg's cognitive development theory and Chickering and Reese's developmental tasks for optimal student growth and success [5]. Studies have also indicated that schools with an academic rigor culture cheat less on examinations than institutions without one [5], [11].

A portfolio assessment places less emphasis on a one-time event and more emphasis on a progression of academic events that make plagiarism easier to detect. [12]. The author of [13] describes a portfolio as a collection of works created over time. It can demonstrate how a student's talents evolved in a given setting. Some portfolios focus on formative characteristics,

such as the approach to self-regulated learning via iterative feedback methods [14], and some others use portfolios to prove student achievements to represent student accomplishments for future employment purposes [15]. When changes occur rapidly and resources are scarce, such as during the COVID-19 pandemic, it is rarely appropriate to conduct separate sets of activities for formative, summative, and sustainable objectives; assessment methods must therefore encompass all perspectives [16].

We found several studies that examine portfolio assessment, its advantages and disadvantages, but little about the process of transition from written examination to formative assessment as part of portfolio assessment in a blended learning context. This study focuses on experiences in the shift in the assessment form in such an environment. The paper's main contribution is the reflection about the strengths and weaknesses of the portfolio as an instructional and formative assessment method, which can be a valuable starting point for developing similar courses at other universities.

## III. CASE AND RESEARCH METHOD

### A. Case description

Programming 2 is a software engineering course in Java, focusing on object-oriented concepts and productive use of developer tools such as IDEs, build systems and version control. It has a scope equal to 10 credits in the European Credit Transfer System (ECTS). It is taught to first-year students at several undergraduate Computer Science programs at the university. All students have experience with a traditional four hour written exam before taking this course. The population consists of 219 students: 105 on campus A, 66 on campus B and 48 on campus C. Figure 1 shows the structure of how the course is organized across campuses.

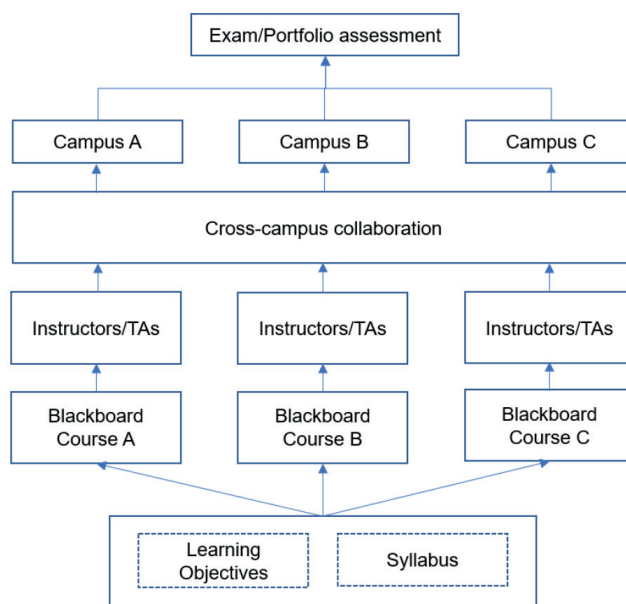


Fig. 1. A cross-campus case following the same curriculum and exam but with different locations, instructors and Teaching Assistants (TAs).

The university offers the course at three geographically dispersed campuses, each with its students and instructors. To facilitate more effective learning in this cross-campus setting, Programming 2 has been divided into three sub-courses. Each sub-course has its course code, associated teaching staff, and discrete online areas in our Learning Management System (LMS) called Blackboard<sup>1</sup>. There are also minor variations in the progress plan at the different locations. However, these practical and administrative considerations should not affect the defined learning outcomes, curriculum or assessment process, which are identical across campuses.

1) *The course before COVID-19:* We initially designed the course around on-site teaching and an emphasis on lab activity and physical presence. Thus, before COVID-19, we conducted the training in an auditorium or classroom and performed guidance in a lab, and teaching assistants evaluated assignments in a face-to-face setting, promoting an active learning environment [17]. The course material consisted of a textbook ("Objects First with Java: A Practical Introduction Using BlueJ") [18], online resources and various examples (Java code) covering the main topics listed above. As for the evaluation process, we gave five mandatory assignments throughout the course. The first two were given as a combination of multiple choice tests and minor coding exercises, while the last three focused on application development. All assignments had to be solved individually and then approved by a teaching assistant/teacher on each campus. Approval of these compulsory assignments enabled the student to proceed with a five hours written exam. The student was ultimately graded A-F based on this final, summative assessment.

2) *COVID-19:* The COVID-19 pandemic and the subsequent closing of campuses had a significant impact on the course. We shifted to remote platforms and online interaction. In the early days of the pandemic, this led to somewhat rushed and improvised solutions in the education practice similar to Emergency Remote Teaching (ERT) [19]. We turned lectures with physical presence into online webinars, and students had to take the final written exam from home. At this time, the longevity of the pandemic was uncertain, so when planning for the subsequent run in the spring of 2021 we had to take COVID-19 into account. Since we could no longer rely on teaching methods that required physical presence, a transition to online education was imperative. This condition led to some new thinking regarding our online presence and a re-evaluation of the assessment protocol. We present the practical outcome of these considerations in the following sections.

3) *A new online presence:* As the University was forced to embrace digital teaching due to physical restrictions, the course coordinators and teachers had to identify suitable online tools for lectures and interaction. Campus A chose Zoom<sup>2</sup> as a digital platform for student-teacher interaction, campus B went with Blackboard Collaborate<sup>3</sup>, while campus C

preferred Microsoft Teams<sup>4</sup>. Each platform had its merits with regard to integration with our LMS. Blackboard Collaborate is fully integrated, so recorded sessions were made available to the students without requiring further assistance. In contrast, recorded videos from Zoom and Microsoft Teams had to be manually uploaded to content delivery platforms supported by the LMS. However, Microsoft Teams also saved the videos directly on a server the students could access anytime, just by being a member of the channel/team. The students were also provided with other communication channels like Discord for interacting with the teaching assistants.

Due to COVID-19 restrictions in 2021, the course had to consider both digital and physical teaching. As a result, the learning process became a hybrid model. Some teaching sessions were held on campus, while others were broadcast live on digital platforms. Recordings were distributed to students on our LMS platform afterward.

4) *Shifting to portfolio-based evaluation:* The teaching staff decided to switch to portfolio evaluation for the spring semester of 2021. Several principles guided its design. The new approach had to be formative and provide ongoing feedback to the students. It also had to incorporate control mechanisms aimed at reducing the risk of cheating. And although it was accepted that the shift would require significant effort from the teaching staff, the arrangement had to be maintainable over time with limited resources. The students do a lot of group work activities in a course running in parallel with this one, hence we decided that the portfolio in this course should be based on individual work.

The portfolio was divided into three parts. Part 1 measured learning objectives covered in the first half of the course and accounted for 15 percent of the final grade. Part 2 focused on learning objectives covered in the second half of the course and accounted for 25 percent of the final assessment. Part 1 and 2 were given as larger coding assignments. The students had to develop fully functional applications and show proficiency in the use of version control and build systems. They had approximately three weeks to finish each part. Part 3 was given as a mini-project and accounted for 60 percent of the final grade. The students had four days to complete it. The mini-project consisted of application development (40%), a small coding assignment focusing on inheritance (10%), and a written reflection of one's own work (10%).

Students were given written feedback both after part 1 and part 2. Deliveries were initially reviewed by teaching assistants as a time saving measure. Detailed evaluation criteria were developed for each part, with each criterion connected to one or more learning outcomes and weighted according to importance. The assistants entered comments and gave scores according to the evaluation criteria by filling out a form in our LMS. A teacher would then assess the integrity of the reviews and make necessary adjustments. A summary of the comments together with the total scores were sent to each respective student. For part 2 the students were given an optional extra

<sup>1</sup><https://www.blackboard.com/>

<sup>2</sup><https://zoom.us/>

<sup>3</sup><https://www.blackboard.com/>

<sup>4</sup><https://www.microsoft.com/en-gb/microsoft-teams/group-chat-software>

task for those of the students that wanted to improve their score from part 1. Figure 2 illustrates the evaluation process for part 1 and 2. Part 3 was evaluated by the teaching staff and external examiners only as a final grading of the portfolio. The students received a final grade covering all 3 parts of the portfolio.

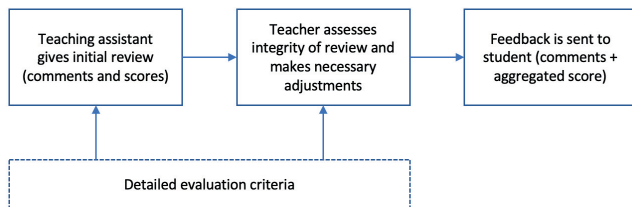


Fig. 2. Evaluation process for part 1 and 2 of the portfolio

The grading policy was reverted from Pass/Fail in 2020 to letter based (A-F) for the portfolio in 2021. This meant that the course would again be included when calculating the total average grade, a practice preferred by most students. It was also thought that portfolio assessment would make it easier to separate student achievements, as well as alleviate the stress often associated with summative assessment, thus lessening the previously noted concerns with letter based grading. Ultimately, the score of each part of the portfolio would be aggregated and converted to a final grade before being published.

5) *Reference group*: As part of the Quality Assurance System of the university, each course must appoint a reference group for each campus at the start of the semester. The reference group should consist of some of the students taking the course. During the semester, three meetings were held between teaching staff and the reference group (a couple of weeks after the start, in the middle of the semester, and after the exam).

#### B. Research Design

1) *Method of Analysis*: In this study, we used a questionnaire to collect both quantitative and qualitative data in an anonymous manner. We asked the following questions for obtaining the students' perspectives on assessment:

- Quantitative: (Q1) *What do you think about the change from a 4 hours written exam to a portfolio assessment in the course?* Possible answers to this question (Likert scale) was: 5 = Very good, 4 = Good, 3 = OK, 2 = Less good, 1 = Not good, 0 = Do not know / Not applicable.
- Qualitative (open-ended question): (Q2) *Why do you think the change to portfolio assessment is good / not good?* Students were able to express their views in a free-text format without a limitation. In addition, we have also analyzed the qualitative data from the reference groups for each campus. These are reports that summarize the students' feedback during the course and the report is typically submitted to university after the exam has been completed.

One of the members of the research group compiled the quantitative data and aggregated the results. Another researcher in the group checked the calculations. A researcher from the team coded qualitative data from the survey. Everyone in the group then reviewed these, and an agreement was made on the final code book. The rest of the data was coded and verified by others in the team.

2) *Limitations*: The questionnaire was distributed only to two campuses as part of the reference groups' mid-term evaluation. The third campus made use of other evaluation methods that was not that easy to quantify. Due to this, and the response rate, our sample data may not be sufficient to determine which form of evaluation is best suited in such a case. New data need to be collected later and analyzed to confirm the findings in this study. As a follow-up, more research is needed to see the trend in developing the assessment form.

The quantitative data collection was coded by one author and checked by another. A double coding of all the reflections would have increased the reliability of the study. However, creating the codebook and limiting the coding agreement between the two coders reduced the risks associated with one coder.

## IV. RESULTS

We have used mixed methods research to combine elements of qualitative and quantitative research approaches.

#### A. Quantitative.

The midterm survey was performed in two of the campuses. A total of 46 out of 99 students answered the survey (46%). Upon answering, the students had completed part 1 and 2 of the portfolio assessment. The quantitative results for the two campuses as a response to Q1 (What do you think about the change from a four hours written exam to a portfolio assessment in the course?) are: 5 - Very good (37, 80,43%), 4 - Good (4, 8,70%), 3 - OK (3, 6,52%), 2 - Less good (2, 4,35%), 1 - Not good (0, 0%), 0 - Don't know (0, 0%). The results show that a large majority of the students preferred the change to portfolio assessment.

#### B. Qualitative.

The response to the open-ended question Q2 (Why do you think the change to portfolio assessment is good / not good?) has been analyzed, and the following main themes have been identified: (1) Relevance to working life/Constructive alignment; (2) Portfolio assessment compared to 4 hours written exam; and (3) Challenges with portfolio assessment.

1) *Relevance to working life*: Several students commented that portfolio assessment enables the students to solve a problem similar to how they expect to work in the industry when they graduate. This also conforms to the theory on constructive alignment [20]: "It provides a more realistic assessment in terms of what it is like to develop an application in a professional setting." Another student writes "It seems closer to the way it will be in working life, something I like."



2) *Portfolio assessment compared to 4 hours written exam:* Some students point out that having a portfolio assessment where the content of the final portfolio is developed throughout the semester, results in less last-minute reading before the exam, and more continuous focus during the semester. In other words, more focus on learning than on the assessment: "With an exam at the end of the semester, you can more easily relax too much at the beginning of the semester and end up with intense studying before the exam which is not ideal in a subject like programming where steady work is important for a solid foundation of knowledge."

Portfolio assessment enables the students to focus more on solving the presented problem in an analytic and sound way, instead of having to rush to be able to finish within the 4 hours of a written exam: "Changing from a 4-hours school exam to portfolio assignments means that you can spend more time writing good code, think a little about the solutions you choose to go for to a much greater degree than before." Another student says: "A 4-hours exam shows exactly what you can do at the moment, while a multi-day portfolio project allows a student to show how good they are at learning and how they can do research to reach the goal in a larger assignment."

3) *Challenges with portfolio assessment:* Although most students are reporting that they find portfolio assessment a much better method than traditional written exam, some students also rise some potential challenges. Since the portfolio is a collection of work through the semester, we do not offer an equivalent of a resit-exam for the students. One student pointed out that this might create an extra challenge compared to the traditional re-sit exam. A re-sit of the portfolio, requires the student to follow the course the next time it is run, and hand in the portfolio-parts during the semester. This can be extra challenging to combine with the other courses in the same semester.

## V. DISCUSSIONS

The results from the survey at two of three campuses show an apparent positive attitude towards portfolio assessment. Portfolios have been used for evaluation in various subjects and fields, while their formats and contents vary greatly, each with its own set of advantages for evaluating student learning. The "cumulative" portfolio, for example, focuses on putting together a series of completed projects [21]. For example, portfolios utilized in the engineering domain are more process-driven and reflective and frequently deal with the advancement of a single project [22]. Portfolio evaluation encourages self-directed learning [23]. Furthermore, due to the feedback, portfolio assessment is highly favoured. As a result, instructors should provide input to bring back learners' active participation and reopen the doors to learning [24]. When students get the possibility of working on real-life projects throughout the semester and get feedback along the way, it can lead to more in-depth learning. Several students commented that portfolio assessment enables the students to solve a problem similar to how they expect to work in the industry when they graduate. This also conforms to the theory

on constructive alignment [20]. Another advantage for the students may be the evenly distributed workload over the semester. In connection with a regular written exam, students increase the workload just before the exam. They rush through the entire curriculum and may also get stressed—some of the students, in our case, highlight this issue.

However, reference [25]'s levels of competence show that portfolio assessment may be time-consuming and often low acceptance by students [25]. Few students also raise some potential challenges with the transition from written exam to portfolio assessment, such as not offering a resit-exam for students. If a student fails, they must wait until the next time the subject is run, in contrast to the written exam, where they can resume the exam shortly after the exam. Despite the advantages of portfolio evaluation, we also have some disadvantages for both students and instructors. Our experience so far points in the direction that portfolio assessment is the right way to evaluate this group of students. We intend to continue this evaluation form after the COVID-19 pandemic period is over and the communities are back to everyday life. This evaluation form can lead to more significant learning outcomes and thus reduce the likelihood that more students will think of cheating. The workload for the faculty members seems to increase significantly. The question is whether there are ways to reduce this workload. This is something we want to study more closely.

New ways of cooperation during exams is available and has been reported in written exams. Journalists have expressed general alarm about rising levels of academic cheating in recent years, blaming much of it on technology and the internet [26], [27]. During the COVID-19 pandemic, the form of the examination had to be changed to a home exam. As a possible way of reducing cheating, the university management decided to change the grading to Pass/Fail. The feedback from several students was that this form of examination was not desirable because a Pass/Fail does not count as part of the average grade for the entire study. This could limit students' opportunities for future careers. Therefore, the course coordinators decided to change to exam to a portfolio assessment, which also was recommended by the university management. The students in this study program were generally satisfied that this form of evaluation can provide more learning outcomes. However, the data is not large and conclusive enough to determine whether the students have increased their learning outcomes.

As part of reducing the possibility of cheating, we introduced reflection notes within the portfolio assessment. Students were asked to reflect on how they solved the tasks by applying the programming concepts such as coupling and cohesion, design patterns, testing and robustness and maintainability/ease of use. Our assertion was that the students who did not understand the tasks and tried to cheat would have difficulty writing reflections with specific examples to their solutions. Although, there is no guarantee that the person in question does not copy other student's reviews, the probability of being revealed for cheating is however greater. The future efforts will investigate in more detail whether such a measure

can reduce cheating during the examination.

Our experience so far points in the direction that portfolio evaluation is a reasonable way to evaluate the group of students taking programming courses. This evaluation form can lead to more significant learning outcomes and probably reduce the likelihood that more students will think of cheating. The workload for the faculty members increases proportionately. Unlike the traditional exam where the evaluation is conducted once, the teachers have to assess the exams/submissions through the semester (six times in current case). A future work in this direction should also investigate on possible ways to reduce the workload while fulfilling the course outcomes in terms of learning and teaching.

## VI. CONCLUSIONS AND FUTURE WORK

In this case study, we looked into the transition from a face-to-face learning environment to blended learning and portfolio-assessment during COVID-19. We focused on the change from the written exam with supervision to portfolio assessment. One of the challenges we faced was the increasing degree of opportunities for cheating during online exams. With instructions from the university management, we practiced portfolio assessment even though the workload increased significantly for the faculty members compared to previous experiences in this subject. Students' feedback throughout the course indicates that this evaluation method may be appropriate for this student group. Observations from our data provide promising direction that it can increase learning benefits. Although we do not have enough data to verify these claims, the follow-up works are intended to verify these observations in the future. The paper's main contribution is the set of ideas regarding a change in assessment form triggered by the COVID-19 pandemic, which can be a valuable starting point for developing similar courses at other universities.

As part of future work, it may be appropriate to look at ways to conduct portfolio assessment that reduces the workload for the instructors and that it is scalable in line with the number of students. As a further study, we want to look at whether this form of evaluation reduces cheating. We have tried to introduce a reflection note as part of the tasks to detect attempts at cheating more easily. This must also be studied in more detail to see if it contributes to less cheating or reveals those who have tried to cheat.

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