National Prior Knowledge Test in Programming
How proficient are incoming higher education students?

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The implementation of Kunnskapsløftet 2020 (LK20) has made programming a mandatory part of the curriculum within mathematics subjects in secondary school [1]. Three years later, the first cohort of students with this programming experience entered higher education institutions. This existing programming competence can have significant implications for the teaching of ICT subjects at universities and colleges. If students already possess a solid understanding of basic programming elements, instruction can be intensified and reach a more advanced level as early as the first semester. However, it is necessary to investigate whether this is the case. There has been substantial variation in the quality of programming education during the implementation of LK20 [2] [3]. Teachers' knowledge of programming varies greatly, with some having computer science didactics as part of their education while others have never coded before. Therefore, it is important to assess the extent and comprehensiveness of students' prior knowledge.

The National Prior Knowledge Test in Programming is a tool for assessing students' programming skill. The test covers the fundamental elements of introductory programming taught at different universities and colleges in Norway. The goal of the test is to evaluate students' level of knowledge regarding the curriculum taught at higher education institutions, regardless of what they have learned in secondary school.

The test was taken by 2,133 students (following data pruning, 1,767 individuals) at seven different higher education institutions in Norway[1]. This collective yielded an average score of 46.1%. The students' academic backgrounds exhibited significant variations with potential correlations to their performance. An especially notable factor contributing to the variation in scores became evident when evaluating the students' year of completion of secondary education. By dividing the students into two cohorts, those who graduated in 2023 (n=483) and those who graduated before 2023 (n=1,280), we could discern a specific subset of students who had been exposed to the prescribed curriculum objectives of LK20, including compulsory programming within their mathematical coursework. This division in educational experiences revealed a substantial difference, as shown in Figure 1, with the 2023 graduates achieving an average score of 63.3%, while their counterparts from earlier graduation years achieved an average score of 39.4%. This performance difference indicates that the educational reform has increased the average student's programming proficiency, which shows the potential for elevating the instruction of CS1 in the years ahead as.

However, it is crucial to acknowledge additional noteworthy factors influencing the performance of the 2023 student cohort. Among these factors, the presence of elective programming courses during their secondary school education is significant. When the students who participated in elective programming courses are excluded from the dataset the mean performance of both groups undergoes a reduction, as shown in Figure 2. The 2023 cohort looses a large number of their highest scoring students and their mean score sinks to 54.47%. Furthermore, another pivotal determinant of performance relates to the level of mathematics courses completed by these students. Within the 2023 cohort, those who have undertaken the most advanced mathematics course, Science Math 2 (R2), achieve a commendable mean score of 66.4%. In contrast, those who have completed the most fundamental concluding course, Practical Math 2 (P2), exhibit a notably lower mean score of 38.0%. These observation underscore the importance of considering the extent of a student's involvement in programming, particularly their participation in elective programming courses and

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[1] Participating institutions: University of Bergen, The Norwegian University of Science and Technology, University of Oslo, Kristiania University College, Norwegian University of Life Sciences, Western University of Applied Sciences and University of Stavanger.
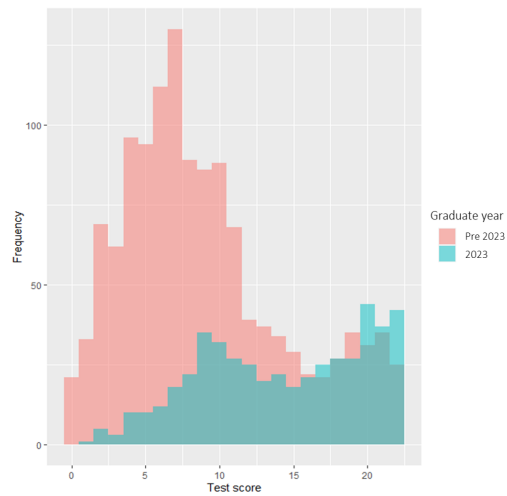
Fig. 1: Test score distribution of the 2023 students (n=483) and those who graduated in preceeding years (n=1280).
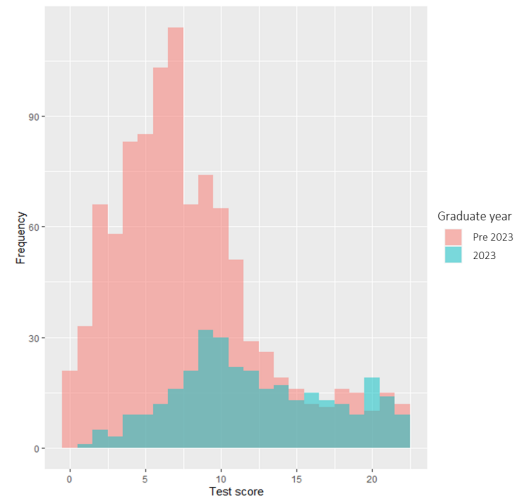

Fig. 2: Test score distribution of students with no elective programming courses, 2023 (n=318) and pre 2023 (n=997).

enrollment in advanced mathematics courses, the latter often being a prerequisite for admission to ICT study programs.

KL20 appears to have yielded a noteworthy increase in the proportion of students who have a strong foundational understanding of programming. Nonetheless, a significant portion of the students continues to exhibit less proficiency in this domain. The findings from the National Prior Knowledge Test in Programming offer encouraging prospects for the advancement of computer science education in Norway. Nevertheless, it remains evident that a substantial number of students still need to commence their higher education in computer science with rudimentary knowledge.

References

1. Kunnskapsløftet 2020. https://www.regjeringen.no/no/dokumentarkiv/regjeringen-solberg/aktuelt-regjeringen-solberg/kd/pressemeldinger/2018/fornyer-innholdet-i-skolen/id2606028/?expand=factbox2606064, hentet: 2023-10-12
2. Frantsen, T.: Å vere lærar i programmering utan å kunne programmere. Master's thesis, OsloMet-storbyuniversitetet (2019)
3. Stenlund, E.: Programmering og Fagfornyelsen. Master's thesis (2021)