Retention in First Stage Undergraduate Computing: Lessons Learned from a Collaborative Learning Intervention

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ABSTRACT

It is challenging to retain computing students through their first stage of undergraduate education. Attrition is high, with many transferring courses or dropping out. This poster explores preliminary findings from an action research project improving continuation in first-stage undergraduate computing. Five years of data from Falmouth University's Games Academy in the UK suggest improvement in first-stage retention from 66.6% in 2017-18 to 91.2% in 2021-22. Findings support prior work on pair programming, media computation, and peer instruction. However, they also highlight the benefits of collaborative learning facilitated by faculty and informed by learning analytics. Peer reviews and pre-submission clinics, student advisor follow-ups, and retrieval via synoptic assessment also contributed to the improvement.

KEYWORDS

action research, retention, continuation, completion, progression, learning analytics, collaborative learning, formative feedback, student advisors, synoptic assessment, programming tutors

1 CONTENT

Computing educators often struggle to retain all the students they initially enrol. Attrition in the first stage is typically 28% [1]. As such, there is considerable interest in introductory programming and the 'CS1' experience [2]. Considerable study is needed to attain even foundational mastery. However, it isn't clear whether this is absolute. The student journey isn't well-understood and many approaches could expedite learning. Several recommendations have merit [4]: pair programming; media computation; and peer instruction. These focus on learning design. Though, the overall student journey is also important to consider. There is increasing attention to learning analytics to glean insights into this journey [5] and the use of collaborative methods to enrich it [3]. However, the effectiveness of these new approaches is held back by the ability to meaningfully intervene, which is often mired by institutional resource constraints—a lack of available funding. So, even where there is evidence that such interventions can be successful, it is challenging to present a convincing cost-benefit analysis.

The Games Academy at Falmouth University is a multidiscinplinary department of around 1000 students, located in rural Cornwall. In 2017-18, first-stage computing retention was 66.6%. The UK government threshold for acceptable continuation is 85% [6]. As such, an action research project was convened, focusing on the aforementioned triplet of best practices [4]. This saw improvement to 80.0% in 2018-19 and 86.2% in 2019-20. Though, it dipped to 78.3% in 2020-21 during the lockdowns of the COVID-19 pandemic. Analysis revealed several reasons for withdrawal: personal, 10.0%; health, 20.0%; failure, 27.5%; and change in career plans, 42.5%. Excluding those transferring to apprenticeships during lockdowns, a dislike for programming or mathematics were frequently cited, with a high proportion changing career direction due to course-related struggle.

Further work in 2021-22 improved retention to 91.2%. Little changed in terms of core curriculum or learning design. Small weekly collaborative learning groups were introduced; formed of 8-12 students facilitated by a named programming tutor selected from faculty. Several sources of data directed support: peer evaluations from group projects; peer reviews of draft work; git repositories; and case notes from the institution's 'student advisor' professional services team. Pre-submission peer reviews and clinics were introduced, with those absent being contacted by a student advisor. A synoptic assessment process to retrieve outstanding work helped students who would have otherwise been forced into a study break. These interventions are now bringing the challenges students face into focus. Learning design is just one piece of the puzzle. Qualitative data is informing these novel support systems, with cost-benefit analyses being conducted to identify the most beneficial interventions. Though ongoing, these indicate that investment in community enrichment is worthwhile.

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