Pilot studies for a flexible, competency-based course in Quantitative Biology (July 2022)

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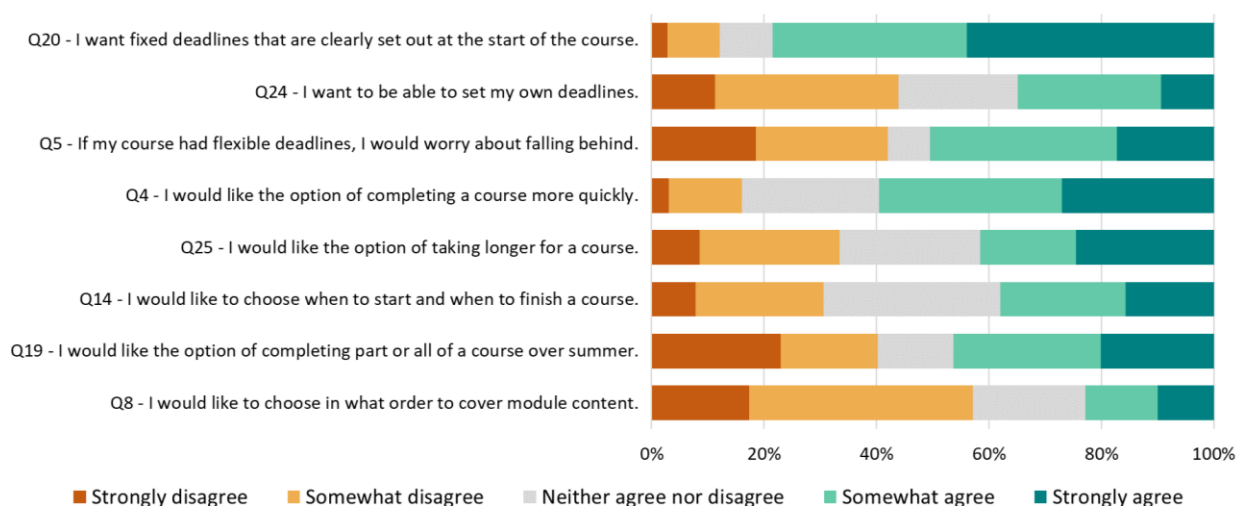**ITL Fellowship Project 2021/22 (Appendix A)**

This project explored to what degree and in what form students value flexibility in their studies. For the best learning experience, how should we balance flexibility vs timetabling, structure vs openness and guidance vs independence? What kinds of materials, assessments, feedback and support keep students engaged and motivated if we stretch flexibility beyond current conventions?

In the long term this insight will be used to build a flexible course in quantitative biology (data handling and analysis, statistics); a field that particularly lends itself to flexible, independent study. During the project phase 2021/22, we conducted an anonymous Qualtrics survey and several focus groups to gauge students' views (UoM ethics Ref: 2022-13555-21965). The survey was sent to ca. 2000 students in the School of Biological Sciences. Between February and March 2022, 255 students accessed the survey. For the 22 questions described below, responses ranged from n=212 to n=236.

Flexibility in teaching and learning can be defined in many different ways (Tucker and Morris, 2011; Li and Wong, 2018; Nikolov *et al.*, 2018, Jonker *et al.* 2020). Online learning - and in particular, of course, the pivot to online-only teaching during the pandemic- has shone a spotlight on flexibility of pace and place (when and where students learn). However, flexibility of content and assessment ("what"), as well as of activities, resources and teaching approach ("how") also contribute to student choice and potentially engagement. The survey questions have been grouped thematically by "when", "where", "what" and "how" (Nikolov *et al.*, 2018). Some of the key questions were asked twice but phrased in 'opposite' ways. The "agree"/"disagree" answers were not exactly flipped for these pairs, pointing perhaps to a margin of error in the survey.

"When": Flexibility of pace, duration, sequence

Participants had a clear preference for pre-set deadlines, and there was a surprisingly strong opposition to flexible sequencing of module content. More students disagreed than agreed with the proposition to set their own deadlines, and half of the respondents worried about falling behind if they were given that option (although almost as many disagreed; half of those 'strongly'). Along the same lines, there was limited enthusiasm for flexible start times, although 60% liked the option of completing a course sooner than scheduled. Completing a course over summer was a polarizing proposition, with similar numbers (strongly) opposed


Q20 - I want fixed deadlines that are clearly set out at the start of the course.
Q24 - I want to be able to set my own deadlines.
Q5 - If my course had flexible deadlines, I would worry about falling behind.
Q4 - I would like the option of completing a course more quickly.
Q25 - I would like the option of taking longer for a course.
Q14 - I would like to choose when to start and when to finish a course.
Q19 - I would like the option of completing part or all of a course over summer.
Q8 - I would like to choose in what order to cover module content.

■ Strongly disagree ■ Somewhat disagree ■ Neither agree nor disagree ■ Somewhat agree ■ Strongly agree

as (strongly) in favour.

This survey did not explicitly include questions about students' views on asynchronous vs synchronous teaching, although this is in part addressed in the section "where".

There seems to be limited appetite for flexibility of timing, whether for a course overall or individual deadlines. Other than the option of completing a course ahead of time, students did not wish for flexibility beyond current practice, which already allows for asynchronous, self-paced access to learning resources via the Virtual Learning Environment.

"Where": Flexible learning environments

Between the on-campus and online environments, flexibility is highly valued. More than half of students are happy to enrol on an online-only unit (and almost 40% enthusiastically so). In contrast, about 1 in 6 respondents were strongly opposed. However, opposition to a hypothetical "on-campus only" course was far stronger; the most decisive "strongly disagree" of all 22 questions.
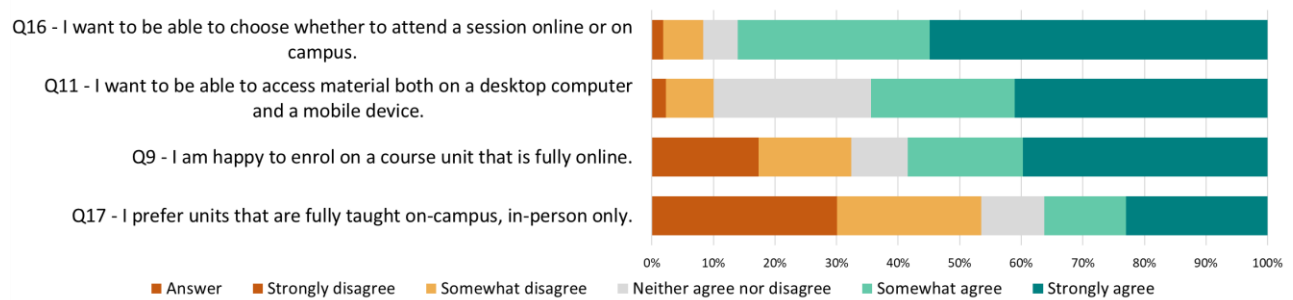
"What": Flexible aims, content and assessment

Choice in the available learning resources is clearly valued, including media formats and potentially redundancy (presented here as "different examples explaining the same idea"), but at the same time almost 90% of students expect clear signposting of learning tasks and material to study. Flexibility of the nature/format, weighting and level of difficulty of assessments is currently uncommon and welcomed by a majority of respondents, albeit with some opposition for the latter two.
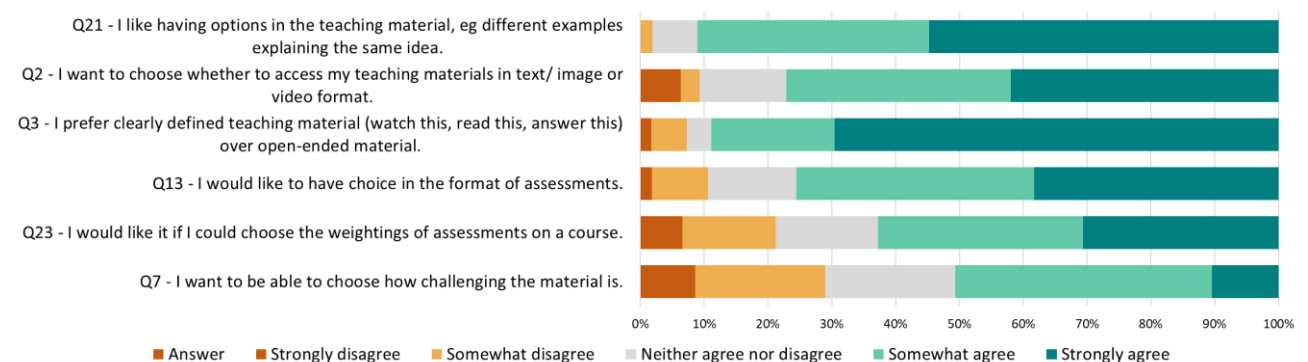
"How": Flexibility of teaching and learning strategies

These questions were phrased as direct preference rather than about flexibility, as perhaps they should have been. A clear majority of respondents prefer working on their own over teamwork, and almost half dislike courses that include such tasks. Fewer than half value peer review exercises. Drop-in sessions are taken up by a small majority of students.

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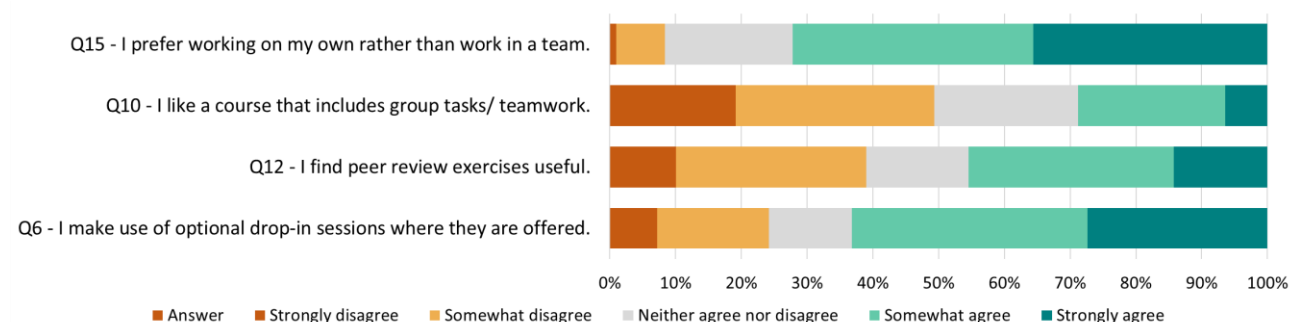
From all the answers, the picture that emerges is one of limited appetite for exploring radical new avenues in flexibility beyond those already embedded in current practice: Choice in setting deadlines, flexible sequencing of content and (less strongly) the option of earning credits over summer were largely rejected. Students are positive about the availability of online learning resources and welcome variety in mode and content, while expecting to be guided rather than given open-ended material. There may be scope for exploring greater flexibility in assessment format and providing more resources in mobile-friendly formats.

Focus groups

In the focus group sessions, students were enlisted as co-creators of a planned new unit on data analysis and statistics. Volunteers were invited to leave their contact email in a separate survey linked from the anonymous one summarized above. Almost 30 students did so and were invited to one-hour focus group sessions; eventually nine students took part in three groups.

The sessions opened with a question about which semester a new unit on Quantitative Biology would ideally be timetabled for. While much of that discussion is specific to individual choices in our modular programmes, a suggestion to offer such a course in both semesters emerged. This is not common practice in our programmes but a logical point to arrive on when discussing flexibility. Students appreciated that some suggestions might be unrealistically resource intensive. On the topic of a course running over summer, opinions in the focus groups were divided as in the survey. However, a suggestion emerged to open an online course early for viewing and studying- from September before the start of year 2, perhaps even from the first year, but then with deadlines during semester time in year 2.

Very broad support for online learning materials emerged in the discussions. The participants had all experienced more online teaching than face-to-face. While there was frustration with lack of direct contact, criticism of online teaching was limited to the live, 'interactive' zoom lectures of the pandemic era ("*I don't think I have ever been in a successful break out room*") and to those courses where teaching materials took the shape of long lecture videos. Well- structured, manageable sequences of "chunks" of text and video were mostly welcomed, though not universally ("*SoftChalk is PTSD for me*").

For the face-to-face component, workshops were much preferred over question-and-answer sessions in lecture theatres. The latter frequently suffer from lack of contributions (questions on course material) and unwillingness, or inability due to lack of preparation, to engage with teacher questions. Workshops allow for application of learned material, peer to peer teaching and academic stretch in a more decentralized way. An additional suggestion was made for in-person seminars on data misuse and ethical questions in data science.

Lively discussions arose over the question of group work in a data-focussed course. Some viewed it as an opportunity to make contacts and welcomed it if group formation was

engineered as part of in-person sessions, as it is in a current Year 1 course; others rejected mandatory group work outright. In the specific context of problem-solving sessions and applying fundamental principles, group work was more welcome as long as any assessments tied to it were formative.

Interestingly, mirroring the trend in the survey, students frequently brought up a preference for continuous assessment across the course. The option to skip ahead was a positive feature of self-paced learning, but there was also a frank admission that lack of fixed deadlines means work won't get done: "*with the whole brunt of learning being online, it's very much like it's too flexible, it's really too flexible*". Opinions varied about the relative weight of weekly/monthly assessments versus a final exam, but there was a consensus in favour of a major applied case study that would test an understanding how the principles are applied "in the real world", rather than an exam that invites 'cramming'. Some groups suggested that a choice of data/ cases from non-biological fields would be welcome, such as finance, considering that many bioscience graduates end up in non-scientific careers.

Next page: Survey responses in decreasing order of total "strongly agree"/"agree" votes.