Eleven years of experience with online and in-class Quantitative Genetics

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Summary

An online version was added in parallel to provide a lecture-less format of a course in classic Quantitative Genetics. Eleven years of parallel offerings of the two versions have generated observations on how students approach the online (distance education, DE) version as compared to the in-class (IC) version. Students self-select the version of the course they prefer and the students’ approach to learning differs between the two versions. DE students generally complete the same number of practice quiz attempts as IC students but do not perform quite as well on the graded quiz assessments that follow. DE students are more interested in accessing podcasts for specific topic content rather than reviewing entire lectures. DE students also generally do not perform as well as IC students in the final grade for the course. However, on course evaluations both groups report similar levels of satisfaction with the course format, instruction and delivery.

Keywords: quantitative genetics, online course, quizzes, podcasts

Introduction

A traditional course in Quantitative Genetics has been taught at the University of Guelph for well over 50 years following the publication of Falconer (1960). The author has been the course instructor since 2000. In 2007, an online (distance education, DE) version of the course was added in parallel to the in-class (IC) version. It was observed that many students successfully completed the IC version without attending class so a “lecture-less” version of the course was developed to accommodate preference while addressing a classroom space crunch. The result is 11 years of observations from the parallel offerings on student performance and preference in online versus in-class formats.

The delivery mode of the in-class version of the course changed from lecture and lab format to lecture and online quizzes replacing the lab function. Lectures have been captured as podcasts or lecture-casts since 2006. Currently students get a synchronized real-time audio and video presentation of lecture slides with live annotations via tablet and stylus.

Weekly online quizzes are paced about one per week with a gap for the midterm quiz. Each weekly quiz set consists of a ten-question, randomized practice quiz that is graded immediately, providing extensive feedback with unlimited attempts and a fifteen-question randomized graded quiz consisting of 10 similar questions plus five additional application and thought provoking questions. Both versions of the course have identical grading schemes; 40% for ten graded quizzes, 15% for an online midterm quiz and 45% for a traditional, sit down final examination.

Materials and methods
MBG-3060 Quantitative Genetics is a third year course required for students in B.Sc. Animal Biology and B.Sc. (Agr.) Animal Science majors. It is a restricted elective for B.Sc. Molecular Biology and Genetics majors. The course is taught in the winter semester, January to April. Enrolment for the course was 103 in 2000 growing to 238 in 2006. When the DE version started in 2007, enrolment in the IC version was 176 with 120 in the first DE offering. Enrolment continued to grow to a peak of 269 in the IC version and 162 in the DE version for a combined enrolment of 431 in 2016. Changes to the genetics curriculum and pre-requisite stream dropped that slightly to 309, 211 in the IC version and 98 in the DE version in 2017 which is likely to be the typical enrolment range for some time to come.

Podcast use survey

In addition to observations, course evaluation comments and ad hoc feedback, with University of Guelph Research Ethics Board approval, students were surveyed for their podcast use habits in 2007. 45.4% (80) of IC students participated and 26.9% (32) of DE students participated in the survey.

Results and discussion

Observations

Enrolment

Consistently, over 97% of the DE enrolment was made up of University of Guelph degree students. Virtually all of those students were on-campus students who wrote the final examination on campus. Very few degree students each year (2-4) wrote the final examination at a remote location. At the beginning of the semester, each student was required to complete an introductory discussion post and many voluntarily reported choosing the DE format for scheduling flexibility, commuting, job hours and/or learning preference reasons. Generally, the DE version was fulfilling the initial premise that students would select this format in order to join the legions of students who were able to successfully complete the course without attending lecture.

Students were able to self-select which version of the course they preferred most of the time. There were some years when, towards the end of the registration window, some students were only able to select the DE version due to classroom size limits in the IC version. Enrolment patterns in the last two offerings when classroom size has not been a limitation suggest a steady state of 1/3 DE and 2/3 IC students. Historically there have been two offerings when slightly over half of the students were in the DE version. It should be noted that DE courses carry an additional $75 enrolment fee due to historical financial support models in the institution so there is a small financial disincentive for the DE version.

Attendance in lecture showed a consistent pattern over the years, dropping to about 75% attendance within a week or two of the start of the semester and fluctuating somewhat lower during times of peak academic pressure in the mid-semester period. Students in the DE version of the course were always invited to attend lecture should they be so inclined but that was not a popular option further reinforcing the notion of self-selection for no lecture.

Online quiz use
The online quizzes were launched in the 2005 offering as a replacement for the labs and paper-based assignments that were part of the original design dating back to the 1960s. The goal with the quizzes was to create an online learning environment that would mimic the role of the teaching assistants and instructor in the labs by providing practice and graded quizzes with extensive feedback for self-paced learning and self-assessment. The quizzes were ported to the DE version with exactly the same deadlines, question bank and format so DE and IC version students have been doing exactly the same quizzes from 2007.

Practice quizzes are available for an unlimited number of attempts. At the beginning of the semester, students in the DE version and in the IC version typically complete 2.5 practice quiz attempts for each quiz. As the semester stretches out, students in both versions complete fewer practice quiz attempts, dropping to 1.5 attempts by the last week of the semester. The randomized elements of the quizzes and the extent of the feedback are similar throughout the semester so the decline in practice quiz use can likely be attributed to student acclimation to the quiz process, their comfort with the role of the quizzes in their learning and a growing workload in other courses.

Both practice and graded quizzes are open for a span of eight days. Within that time span, students may enter and leave their quiz as often as they like allowing for and encouraging collaboration. Graded quizzes are formative assessments with the grade allocated as incentive to encourage students to keep pace with the material. There is an opportunity to achieve full marks on every quiz with the generous time limit and open collaboration opportunity. DE version students generally averaged 3-4% lower on graded quizzes than their IC counterparts; 84-89% compared to 87-93% respectively across all 11 class cohorts.

**Overall student performance**

With the final exam making up close to half of the grade assessment, students in both the DE and IC formats are almost equally assessed on their individual performance and their (potentially) collaborative performance. The difference in final grades between formats across all 11 cohorts varies much more than the online quiz grades. This greater difference is attributable to final examination performance as well as variation among student cohorts across years. The final examination difficulty is designed to be similar across years but varying the questions and achieving a constant level of difficulty is challenging. Generally, students in the IC version outperform the students in the DE version on final grade with that difference being as much as 6% but in one instance, DE students outperformed their IC counterparts by 0.1%. The final exam performance difference combined with the quiz grade difference usually amounts to a letter grade difference in the average final grade with the IC cohort generally averaging in the high B+ to low A- range (77-82%) and the DE cohort averaging in the B to B+ range (74-78).

**Student course evaluations**

Beginning in 2013, student course evaluations were harmonized across the two versions. Prior to that, the DE version had a different set of course evaluation questions and could not be compared to the IC version. The overall course evaluation assesses instructor effectiveness, course presentation and course organization. For 2013-2017, overall course evaluations fluctuated more for the DE version but were generally similar; 4.46 for DE and 4.49 for IC, out of 5. Course evaluation participation is voluntary so fluctuations in evaluation
participation were probably responsible for the fluctuations in the DE version evaluations. These results suggest that students are equally happy with the format of the course they have chosen and find the format and instruction to their liking in spite of the overall performance differences described above.

**Podcast use**

Students were surveyed on how they accessed the podcasts and their technology platforms along with the pedagogical aspects of their podcast use. Given the age of the survey data, the technology questions are no longer relevant. However, the pedagogical questions are of interest and the results reflected marked differences in how the students were using the lecture capture media in their learning. Current access and usage data from the online learning management system for the lecture-casts suggest that the pedagogical reasons for accessing these media have not changed dramatically but only a repeat of the survey would confirm that for sure. The survey results are shown in Table 1. In the 2007 survey, students in both formats were presented with the same questions. The responses to two different questions are shown in separate blocks; how were the podcasts used and how important were the podcasts to the course. The options provided for student responses are summarized in the survey question column. It should be noted that some DE version students attended lectures so the survey results reflect this.

Generally, DE version students were more likely to use the podcast in lieu of exercising the option to attend class while IC version students were more likely to use the podcast as a safety net in the event they were unable to attend class. Students in both versions of the course found the podcasts to be a useful add-on to the course as opposed to an essential or occasional use element. Of note is an aspect that was also reflected in the comments on the survey; the DE cohort students were much more likely to use the podcasts for a “just in time” approach to learning. This indicates DE version students were more likely to use the lecture capture media to hear an explanation about specific quiz questions they were struggling with or to get a topic explanation while studying for examinations rather than listening to entire lectures. Based on this information, subsequent offerings of the course have included a summary of topics covered in each podcast to allow students the option to find specific topics they may want to access.

**Conclusions**

Experience has shown that students have approached the DE version of Quantitative Genetics in a different way than students in the IC version of the course. Students are generally able to self-select the format of the course they prefer with about 1/3 of the annual cohort preferring the DE format. Although students in the DE version tend to receive a lower quiz and final grade on average compared to students in the IC version, they report the same level of satisfaction with the course format, instruction and delivery.
Table 1. Survey results for the pedagogical aspects of podcast use.

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>DE</th>
<th>IC</th>
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</thead>
<tbody>
<tr>
<td>Podcast used to review lecture material</td>
<td>24%</td>
<td>25%</td>
</tr>
<tr>
<td>Podcast used for a missed lecture (unplanned)</td>
<td>16%</td>
<td>43.3%</td>
</tr>
<tr>
<td>Podcast used for missed lectures (planned)</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Podcast used to replace lecture attendance (planned)</td>
<td>40%</td>
<td>11.7%</td>
</tr>
<tr>
<td>Podcast is an essential element of the course</td>
<td>30%</td>
<td>27.7%</td>
</tr>
<tr>
<td>Podcast is a nice add-on to the course</td>
<td>43.3%</td>
<td>53.8%</td>
</tr>
<tr>
<td>Podcast is an occasional use component of the course</td>
<td>13.3%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Podcast is useful in for specific topics / concepts</td>
<td>10%</td>
<td>3.1%</td>
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List of References