Distance Education: A Short-term Solution to Training Graduates and Producers With a Shrinking Population of Quantitative Geneticists

K. D. Bullock[*], R. M. Lewis[†], R. L. Weaber[‡], B. B. Lockee[†], D. R. Strohbehn[§], D. J. Garrick[§] and E. J. Pollak[**]

Introduction

The United States is experiencing a rapid reduction in the number of students receiving doctorate degrees in quantitative genetics (Lewis et al. (2008); Misztal and Bertrand (2008)). The likely predominant reason is competition for resources from molecular genetics. When positions in quantitative genetics become available they are often left vacant or filled with molecular geneticists. Cornell University, historically a leading institution in quantitative genetics, has reduced its quantitative genetics faculty from six in the 1980's to zero. This has been the trend at many agricultural institutions in the US; most have one or no livestock quantitative geneticists.

In the land grant system of the U.S. each state has an agriculture college with the mission of research, instruction and outreach. For undergraduate students this poses a significant problem; with no quantitative geneticists there is a void in the students' training. There is risk that students with enthusiasm for quantitative genetics will lack encouragement or opportunity to pursue that interest. Graduate training of quantitative geneticists is also becoming a concern; institutions with limited faculty have a difficult time providing students with a balanced, diverse quantitative genetics education.

Outreach is another area impacted by the shrinking availability of quantitative geneticists. Within the land grant system there is a hierarchical approach to outreach; each institution will typically have "specialists" that are species specific. These specialists provide training to area/county agents who in turn conduct educational programs directly to producers. Specialists also provide consulting directly to producers, usually at the request of the local agent. In an ideal setting there will be enough specialists at an institution to allow discipline specialization within a species. However, most states have one or maybe two specialists; in most cases that specialist is trained in nutrition, but provides educational programming and consultation on all disciplines, including animal breeding. In the U.S. there are

[*] University of Kentucky, Lexington, KY 40546, USA
[†] Virginia Tech, Blacksburg, VA 24061, USA
[‡] University of Missouri, Columbia, MO 65211, USA
[§] Iowa State University, Ames, IA 50011, USA
[**] USDA-ARS U.S. Meat Animal Research Center, Clay Center, NE 68933, USA

approximately ten beef cattle quantitative geneticists with a primary Extension faculty appointment.

The leading institutions involved with beef cattle genetic evaluation (Colorado State University, Cornell University, Iowa State University and the University of Georgia) formed the National Beef Cattle Evaluation Consortium (NBCEC) in 2001 to consolidate their efforts with a shrinking population of quantitative geneticists and dwindling funds available for research. From the outset, one of the NBCEC's missions was to provide a national outreach educational program focused on beef cattle breeding. More recently the NBCEC recognized the limitations of graduate training in quantitative genetics at many institutions and became involved in an effort to provide quality graduate level courses to a broader audience.

The NBCEC has resorted to the utilization of distance learning technologies to overcome limited resources. This paper will address the graduate education and outreach distance learning projects aligned with the NBCEC.

Outreach

Since 2002 the NBCEC has coordinated and hosted an on-line training course for educators of beef cattle producers. This group has included state Extension specialists, industry field representatives, animal breeding graduate students and undergraduate educators. The purpose was to provide up-to-date information on all aspects of beef cattle genetics to the personnel that actively educate current and future beef cattle producers. Periodically surveys have been conducted to monitor the receptiveness of the on-line technology and to assess the impact of the trainings. The survey results of the first training session were summarized by Bullock et al. (2003). Training sessions have been conducted annually since 2002 and periodically participants have participated in follow-up surveys. A total of 97 participants have completed the survey over the course of the trainings, however, since the surveys are anonymous some of the same participants could have responded in different years.

The demographics of the participants were as follows: faculty (34%), graduate students (11%), area/county Extension agents (38%), and other (16%). Those listing other were typically breed association and AI stud representatives. These participants planned to use the information provided in a variety of manners. Most participants planned to use the information to develop educational presentations for producers (66%), and some planned to use the slides provided in educational programs for producers (46%). Additionally, participants planned to use the information in consulting with clientele (64%) and incorporate the information in undergraduate courses (27%). The participants were asked to estimate the number of beef producers they expected to impact with this information and the average of all participants was 451 producers.

Delivery of information in a format that does not allow face-to-face interaction was unique to most of the participants and presenters at the onset. When giving a live audience presentation it is often easy to evaluate the acceptance of materials by the expressions and body language of the participants; this is not possible with this technology. Therefore, we

developed some questions to give an indication of the acceptance of the delivery method and how well the presenters did with delivering the information with this technology. Ninety-eight percent of the participants indicated that the technology was acceptable as a delivery method with 74% classifying that they liked the delivery method "Very Well" or "Excellent". The overall content was very acceptable with 81% rating that they liked it "Very Well" or "Excellent" and 16% rating it "OK". Seventy-eight percent rated the depth as "About Right". Based on participant records, approximately 70 to 90 potential participants register for the training annually and typically between 35 and 70 participate in each live session; it is not known how many access the archived sessions.

These results indicate that training other professionals on animal breeding concepts via the internet is an acceptable and effective method. Since most Extension professionals have not been formally trained in animal breeding this appears to be a cost effective method of getting reliable genetics information to the personnel that play a large role in educating producers.

Graduate Education

Given the positive reception to on-line training for outreach, it was proposed to use distance-delivery to provide Masters degree-level instruction within the US in animal breeding and quantitative genetics. In 2006 an on-line, nation-wide survey was conducted by Virginia Tech, with funding through NBCEC, to ascertain the extent and demand for graduate-level training in quantitative genetics. If demand existed, we sought input on the use of modularized on-line courses to address instructional gaps in current programs. In total, 125 genetics faculty members from 73 Universities were contacted, with 47% responding. Although the survey allowed anonymity, three-quarters of those participating, from 27 Universities, identified themselves. Most of those institutions (78%) trained graduate students in genetics.

The norm for most institutions was 3 to 5 masters-level (43%) and 1 or 2 doctoral-level (38%) students enrolled concurrently. Other programs tended to be smaller. Student numbers at the institutions were stable (67%) or decreasing (28%). Most programs (93%) offered foundation courses, often in alternate years (54%) or less regularly (17%). Half of the institutions offered some specialized courses. Ninety percent of respondents endorsed distance-delivery as a method to redress short falls in their curriculums, with 72% willing to participate in development or instruction of modular courses.

Building on the survey, a consortium of four universities (Virginia Tech, Colorado State, Cornell and Michigan State Universities) combined efforts to develop 8 Masters degree-level asynchronous courses. The ADDIE instructional design model - analyze, design, develop, implement, evaluate - was used for course construction (Gustafson and Branch, 2002). In addition to student feedback, each course was reviewed by four content experts, with at least two from outside the consortium, and a specialist in instructional design. Course materials were accessed through the Blackboard e-Education platform, with audio-presentations delivered with Adobe Presenter. One course - CyberSheep - is a game-based genetic simulation, with across-institutional teams competing through a common web-based interface. Courses typically last 5-weeks, consistent with 1-credit hour. We have held an

annual face-to-face event to encourage social and academic interactions. The curriculum began in Fall 2007, with some courses now having been taught as many as four times. Course development has been supported through a USDA Higher Education Challenge Grant, with no tuition fees levied.

Students from 28 universities have participated, with course enrollment ranging from 9 to 31 students. Student feedback regarding the content of the curriculum has been overwhelmingly positive. Still, distance delivery of programs poses challenges. There is risk of a "psychological distance" separating students and instructors. We therefore have sought information on student comfort with the technology and ethos of on-line learning. Anonymous feedback was provided by 63 of 80 students enrolled. The technologies used were successful, as a vast majority (97%) of students found Adobe Presenter easy to use. Nine students (14%) mentioned difficulties with on-line quizzing, primarily due to browser incompatibilities with Blackboard. An on-line discussion board was used to encourage interaction. Among those participating, 46% and 44% thought it 'very' or 'somewhat' helpful, respectively, in reinforcing course materials. Virtual Office Hours were held for two offerings of the course. Few students attended, largely because of scheduling conflicts across time zones (57%) or not being needed (27%). Most (85%) preferred the flexibility of asynchronous communications through the Discussion Board or E-mail. Concerns regarding the 'distance' in distance-delivery were not realized. Most students felt they had enough interaction with the instructor (77%) and classmates (92%) through the asynchronous tools provided; Instant Messaging was suggested as another way to encourage student interactions.

Similar to Outreach, distance-delivery seems to be an effective and suitable method for graduate instruction.

Discussion

The NBCEC has effectively utilized distance education to train graduate students and those that educate producers in animal breeding and genetics. However, these successes should not translate into an attitude that further reductions in animal breeding faculty can be compensated for with increased distance learning. Distance delivery systems can be leveraged for the sharing of specialized expertise in animal breeding and genetics across institutions; however, on-line curricula in this field will rely on the availability and contributions of graduate faculty in quantitative genetics at land grant institutions.

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