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Teaching Animal Genetics and Breeding: What are the resources available to instructors?

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Abstract

The dynamism of education requires that teaching and learning follow suit. The globalization of education community has made materials for teaching and learning easily accessible but sometimes being aware that these resources exist is challenging. The present resource manual attempts to address this by highlighting some of the teaching and learning resources that are available to the instructor in animal genetics and breeding. The availability of the Internet has improved the access to teaching resources that will be of assistance to teachers and learners. Taking cognizance of this rich resource, a teaching resource portfolio relevant to the animal genetics and breeding has been developed. The portfolio includes some textbook resources for improvement of general teaching skills and course development; educational visual resources such as videos and internet sites; publishing companies that provide teaching texts as well as ancillary teaching resources; some journals relevant to animal genetics and breeding; and brief descriptions of the items contained in the portfolio. Some recommended articles focusing specifically on current issues in teaching that facilitate the process of learning for students as it may pertain to the animal genetics and breeding classroom as well as online sites of relevant humor content resources are provided. As such, this teaching resource manual is timely in providing instructors in animal genetics and breeding with the links to important teaching resources.

Key words: : Teaching portfolio, technology, internet, textbook, multimedia.

Introduction

The evolution of the teaching and learning process in the past decade has been tremendous in different parts of the world. Greater progress is witnessed in developed countries while the third worlds are experiencing gradual growth. Such developments are observed in the inputs (teaching materials preparation and commitment) as well as the ends (student comprehension). One can attest that teaching in most institutions has witnessed a shift from the usual chalkboard to use of electronic teaching aids whereas learning

has incorporated instruments and electronic gadgets that promote easy understanding of subjects. One main factor responsible for these innovations in the classroom is technological development. With few associated demerits such as less use of brain-power, the advance and level of incorporation of new technology has played a significant role in the achievement of these successes. The level of their integration into the educational programs differs among regions, being more incorporated in developed countries than developing nations. Limitations in developing nations range from insufficient infrastructural facilities (for example power supply) to inadequate technical expertise on the use and maintenance of such equipment. These changes have also affected the curriculum of undergraduate education as well as graduate education (Oltenacu, 2002).

Depending on the level of use of these innovations, its impact on learning would have more positive effects on teaching and learning. For example, the incorporation of video and audio media has been observed to be associated with more recall of the subjects among students than when either is used independently (Kozma, 1991). In this case, the combined use of visual and audio technologies may have facilitated the process of learning in the students and eased the activity of teaching.

A wide variety of instruction and learning materials is available either in electronic or print for teachers and students. The internet has facilitated the access to these materials, particularly with the help of powerful data searching engines. The knowledge about their existence and their quality is a great challenge even with the help of these search engines. Another challenge is the choice of words reflecting teaching and learning resources with which to search particular topics or subjects of known existence. This problem exists in both developed and developing countries when it comes to sourcing materials especially with regards to classroom teaching and items to incorporate into the syllabi. This search becomes crucial and can be frustrating if there are many alternative words for the sought material; however this becomes a limitation to acquiring available resources.

The area of animal breeding and genetics is no exception to these technological innovations and limitations. There has been increasing development of new fields such as genomics which integrates computing into genetic research. There is also the expansion and improvement of existing areas in animal genetics. Unlike previous texts on animal genetics, most of the recent text resources are difficult to delineate into which field of genetics and animal breeding the author is dwelling on. Most texts are experiencing the interdependence of these fields on one another given the creation of more areas of genetics. One would think that such mergers reduce the gap between the existing areas in animal genetics. Kotler and Murphy (1981) suggested the need for strategic planning given the vast areas of resources available. Such would enhance the compilation and organization of these available materials into more useful format. In addition, it will also lessen the difficulties associated with accessibility and extraction of useful information

from these texts for the students which will require organization of materials and commitment from the instructor.

The search for these materials has been the inspiration for the present work and has led to the development of the teaching resources portfolio addressing some fields in animal genetics and breeding. The use of the teaching portfolio has been identified as a medium of expressing the scholarship of teaching and might be a mode of evaluation (Edgerton et al., 1998). The extent of preparedness of an instructor is indicative of the extent of development of his teaching portfolio. This also adds value to the education given to students as well as solace to paying parents who are concerned about the education of their wards. The authors noted that parents are not the only ones concerned; faculties are also interested in the reform of institutions. The materials that ensue are indicative of a resource manual or portfolio for new and old instructors as well as students in the field of animal genetics and breeding. Although the list may not be exhaustive, it creates an avenue for access to similar materials. Descriptions given on some of the items are excerpts from the materials or their web pages. These materials are not intended to replace the existing materials but rather to create an avenue for modification (where need be) for greater participation in the teaching and learning processes.

General Teaching Resources

The teaching resources are pertinent to instructors or faculty members. These materials assist faculty members in preparations needed for the different class activities. Veteran or new faculty members also benefit from these rich resources as it relates to classroom activities giving the instructor more knowledge on teaching styles as well learning styles of students. These resources, as seen in Table 1, are usually in print or available at internet sites (Table 2). They address issues related to teaching thereby creating an atmosphere more conducive to teaching for instructors and students. Some studies related to classroom instruction have been carried out by individuals and have been reported in journals. These reports give scientific insight to general teaching and learning behaviors especially in an agricultural classroom setting.

Textbook Resources

There are so many textbooks available for the instructor in animal genetics and breeding. One can only lay hands on a few which depend on referrals from an instructor or colleague. Referrals to a book are usually based on content of the book. These would also depend on the experience of the author in such area. Another criterion is the reader for whom the book was written. The level of technicality of a text determines its suitability for a class of readers, undergraduate or postgraduate students. Tables 3 through 5 contain a list of some textbooks and online resources that can be useful to students and instructors. The areas addressed in this article are mainly for general resources, population genetics and quantitative genetics. The general resource textbooks include some statistics texts and online resources (Table 3) which are useful for most topics in genetics and animal breeding. An area of challenge to most instructors is the acquisition of ideal texts that covers most of the items in the curriculum. Such a text may not be

Table 1: General teaching resources

Cameron, B.J., and Lawall, M. 1997. Teaching at the University of Manitoba: A handbook (2nd ed.). University Teaching Services, University of Manitoba. Winnipeg.	This is good reference booklet for beginning instructors that will be helpful in starting classes, lecture and class group organization strategies. Also included are practical tips for energizing and engaging students.
Feldman, K.A., and Paulsen, M.B. (Eds.) 1998. Teaching and learning in the college classroom (2nd ed.). Simon and Schuster Custom Publishing. Needham Heights, PA.	This is a collection of articles on teaching and learning based mainly on theory and research. The information in the collection gives a good background on teaching although it does not directly address practical situations.
Palmer, P.J. 1998. The courage to teach: Exploring the inner landscape of a teacher's life. Jossey-Bass Inc., Publishers, San Fransisco, California.	This book is based on personal experiences of the author. The book encourages the attitude of being yourself when you teach. Identity and integrity have been noted as key ingredients to this. It also offers suggestions on how to overcome difficult situations in the process of teaching.
Griffiths, A. and Mayer-Smith, J. 2000. Understanding Genetics: Strategies for Teachers and Learners in Universities and High Schools. W.H. Freeman and Co., U.S.A.	This collection of articles identifies student learning problems and methods for improvement in a genetics classroom. It includes suggestions for the instructor on activities that will elicit student discussion on genetics as well as maintain an active class.
McKeachie, W.J. 2002. McKeachie's teaching tips: strategies, research, and theory for college and university teachers (11th ed.). Mifflin Company, Boston, Houghton.	This is a more practically oriented book and is widely known for offering practical solutions to problems teachers face in a typical educational setting. It is recommended for beginning instructors.
Newcomb L. H., J. D. McCracken, J. R. Warmbrod, and M. S. Whittington. 2004. Methods of teaching agriculture (3rd Ed). Pearson Prentice Hall. Upper Saddle River, New Jersey.	This book addresses issues related to problems encountered by teachers in agricultural education. It also gives insight on the learning styles of students.

Table 2: Internet resource sites for teaching.

Georgia Agriculture Education and Curriculum Resource http://aged.ces.uga.edu/	This site contains teaching resources such as pictures, sounds, PowerPoint presentations as well as quizzes on different livestock. It provides some links to useful teaching resources and sources of teaching materials.
Resources for scientists Teaching Science http://instruct.cit.cornell.edu/courses/tar esources/	This Cornell University site provides students and researchers with materials and ideas necessary for teaching. These include links and tips on teaching skills and resource acquisitions.
Teaching Materials in Laboratory Animal Science. http://oslovet.veths.no/teaching/materials .html	This website has a collection of links to web pages and other sources containing teaching texts on subjects related to pure laboratory animal science. These include topics related to ethics, legislation, comparative biology, anatomy, pharmacology and physiology, genetics, anesthesia, analgesia, euthanasia, microbiology, environmental factors, experimental design and techniques.
The University of Hawaii Writing Program. http://mwp01.mwp.hawaii.edu/resources. htm	This site gives a comprehensive list of teacher-assisting resources for effective classroom teaching. It also includes the tips on writing, workshops, syllabi and attending to students. It also give quick tips on managing the classes.

available given that some texts will cover certain aspects better than others. It is certain that most of the texts play complementary roles and are combined with others since information contained in them may not be sufficient for the understanding of the student or instructor given the content. Some of the textbooks (see Table 4 for example) are difficult to be classified under a particular category or field of genetics and breeding. This is due to their heterogeneous content. Table 5 gives a list of some internet sites for obtaining some materials in animal genetics.

Publishing Companies

This section offers a guide to publishers that have large collections of books and educational materials dealing with animal genetics. Most of them publish textbooks and journals that are related to animal genetics and breeding. Some of them also have online access to their library or for ordering educational materials of interest. A list of some publishers and their websites are given below.

a. ***Blackwell Publishing***
www.blackwellpublishing.com

b. ***CABI Publishing*** http://www.cabi.org/

c. ***Pearson Education Inc.***
www.pearsoned.co.uk http://
www.pearsoncanada.ca/www.pearsoned.co.za

Table 3: Textbooks and internet sites on statistics and biometrics.

Steel, R.G.D., Torrie, J.H., and Dickey, D.A. 1997. Principles and Procedures of Statistics: A biometrical approach. 3rd ed. McGraw-Hill, Inc. New York, USA.	This book gives a clear understanding of applied statistics especially for students with a weak background in statistics. It explains statistical procedures from an applied science perspective. It incorporates use of outputs from statistical software.
Laps, M. and Kaps, M. 2004. Biostatistics for animal science. UK. CABI Publishing, Oxfordshire.	The first part of this book provides a good statistics background for students. It covers techniques for analysis of data in animal sciences. More complex applications and procedures for analysis are given in the second part.
Saxton,A.M., Balzarini, M.G., Cappio-Borlino,A., Czika,W., Fry, J.D., Gibson, G., Guerra, J.L.L., Kang, M.S., Macciotta, N.P.P., Pulina, G., Rosa, G.J.M., Stalder, K.J., Tempelman, R.J., Wolfinger, R., Xu, C., Xu, S. and Yu, X. 2004. Genetic Analysis of Complex Traits Using SAS. SAS Publishing, North Carolina, USA.	The book involves the use of SAS in the analysis of molecular and quantitative genetics data. It may be too technical for undergraduate curriculum but will be of great assistance for research and graduate work.
Box, G.E.P., Hunter, J.S. and Hunter, W.G. 2005. Statistics for experimenters: An introduction to design, innovation and discovery, (2nd Ed.). John Wiley and Sons. Inc., New York.	This text has been recommended for undergraduate and graduate students. It gives a wide coverage of statistics as it relates to other disciplines.
VESTAC java applets for visualization of statistical concepts www.kuleuven.ac.be/ucs/java/index.htm	These applets are designed for the purpose of computer-aided education in statistic courses. They are excellent resources for students to understand some abstract statistics concepts based on visualization and simulation. Topics covered include basic statistics, tests, regression and ANOVA (analysis of variance).
Some useful statistical tables- Bob Baker http://homepage.usask.ca/~rjb669/Tables.html	This applet gives critical values and p-values for the standard normal (z) distribution, the t distribution, the F distribution, and the chi-squared distribution. This is a more convenient and excellent alternative to the statistical table in print.
Required Number of Replication Applet- Dr. Bob Baker, Univ. of Saskatchewan http://homepage.usask.ca/~rjb669/NumReps.html	This applet is used to determine the number of replications required for tests of significance in scientific experiments (Randomized Complete Block Design). It has a number of instructions to the user. This site is more useful to students and researchers designing experiments.

Table 4: Textbook resources on genetics.

Crawford, R.D. (Ed.). 1990. Poultry Breeding and Genetics. Elsevier Science Publishers, Amsterdam.	The book gives a critique on scientific literature on poultry in the field of genetics and breeding. Species covered are chicken, turkey, Japanese quail, guinea fowl, ring-necked pheasant, domestic duck, muscovy duck and goose. The book describes various mutations and plumage. Other topics include cytology and cytogenetics, immunogenetics, molecular genetics, genetic engineering, quantitative genetics and finally applied breeding and selection. It is intended for graduate level instruction and research as a reference text.
Van Vleck, L. D. 1993. Selection index and introduction to mixed model methods. CRC Press, Florida.	This text makes good use of matrices and would be too technical for students without a statistics background. It is suitable for graduate courses although some parts may seem very technical, however the text gives good knowledge about selection index and some selected topics on population genetics as it applies to animal science.
Weller, J.I. 1994. Economic aspects of animal breeding. Chapman and Hall, London.	The book gives a good organization of some scientific literature as it relates to economics in breeding programs. Some topics covered in the book include basic concepts in quantitative genetics and economics, selection index, economic evaluation of genetic differences and breeding programs, economic evaluation of crossbreeding and heterosis. It is more appropriate for graduate level studies.
Falconer, D. S. and Mackay, T.F.C. 1996. Introduction to Quantitative genetics, 4th ed. Longman, New York.	This book gives a good theoretical background to most topics in quantitative genetics. The use of mathematics and matrices was minimized in the text. The descriptions in the book makes it suitable for undergraduate reference, however some parts and diagrams are more technical than that level.
Hartl, D. L. and Clark, A. G. 1997. Principles of population genetics. 3rd Ed. Sinauer Associates, Sunderland.	The scope of this book makes it suitable for higher year undergraduate students and graduate students. Limited use of mathematics alongside more elaborate statistics reduces its complexity. It covers topics which include genetic variations, gene frequencies, molecular population genetics and quantitative genetics.
Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C., Gelbart, W.M., Suzuki, D. T., and Miller, J. H. 2000. An Introduction to genetic analysis, 8th ed. W.H.Freeman and Co., New York, USA.	This book tries to improve understanding of genetics for students and instructors by using various learning tools. Topics covered include heredity, chromosome mapping, genomics, gene regulations, developmental genetics, evolutionary genetics, population genetics, and quantitative genetics. There also exists a companion website www.whfreeman.com/iga8e/ containing a variety of interactive materials for students and instructors.
Bourdon, Richard, M. 2000. Understanding Animal Breeding. 2nd ed. Prentice Hall	This text is student friendly, highlighting key words and using diagrams as well as using a minimum of mathematics. It is a good introductory text. Topics covered include selection, mating systems and brief descriptions of biotechnology applications in animal breeding.

Table 5: Online sites for resources in genetics.

Genes for Cowboys. http://homepage.usask.ca/~schmutz/Cowboys.html	This site from the University of Saskatchewan has information on basic genetics as well as economic traits in cattle. It also contains information on other topics such as the DNA testing and gene mapping.
Genetics calculator- Knud Christensen http://www.kursus.kvl.dk/shares/vetgen/_Popgen/genetik/applets/0.htm	This site does most population genetics and quantitative genetics calculations using applets. These include tests or calculations for Hardy-Weinberg equilibrium, linkage, gene/genotype frequencies, relationship and inbreeding, breeding values, heritability, etc.
Genome maps of domestic animals. www.marc.usda.gov/genome/genome.html	This site is owned by the U.S. Meat Animal Research Center and contains genome maps of cattle, swine and sheep giving information on the various identified markers. Tools are also available for searching markers and viewing linkage maps.
Online Mendelian Inheritance in Animals. http://omia.angis.org.au/	The website is owned by University of Sydney, Australia. It contains a large collection of references on inherited characteristics of most livestock, which can be browsed by species, or disorder category, or searched by keywords. The search tool (advanced) can be used to search for keywords and can retrieve single locus traits and diseases which have known DNA mutations.

d. ***Wiley Publishers*** http://ca.wiley.com/WileyCDA/

Journals

Journals relevant to animal genetics and breeding are listed in Table 6 below. This section provides a list and gives direction to appropriate journals for searching relevant topics in the various ongoing researches. This will reduce the time of searching for appropriate journals that report issues relevant to research areas of interest and will also widen the knowledge about such researches.

Articles

Some recommended articles (as seen in Table 7) are drawn from various journals that publish articles on studies related to teaching in the animal sciences. The studies address the observations (merits or problems) that are common in the animal science classroom. Some of them offer suggestions to their solutions. Some contain various teaching and learning styles that improve teaching skills and also enable the teachers to connect with their students. Although there may be wide differences in the environments from which some of the studies were taken, the observations and experiences were similar among institutions regardless of the region. Some of the articles provide common solutions for teaching and/or learning challenges found in classrooms around the world.

Educational Media/ Videos

These include use of visual based teaching and learning facilities. There have been some arguments that the influence of multimedia on learning is limited; Najjar, (1996) indicates that the outcomes on the use of multimedia on the performance of learning are inconsistent.

Table 6: List of some general and genetics-specific journals

Animal Science. British Society of Animal Science. CABI Publishing.
www.bsas.org.uk/Publications/Animal_Science
This journal publishes original research from molecular levels to mathematical models related to breeding and genetics, nutrition and digestion, physiology and endocrinology, reproduction, lactation, growth, health, etiology and welfare, environment and housing, food evaluation, and animal products.

Animal Genetics. Blackwell Publishing.
www.blackwellpublishing.com/journal.asp?ref=0268-9146
This journal reports research on immunogenetics, molecular genetics and functional genomics of economically important and domesticated animals. Publications include the research studies of variability at gene and protein levels. mapping of genes, traits and QTLs, associations between genes and traits, genetic diversity, and characterization of gene expression and control.

Canadian Journal of Animal Science. The Canadian Society of Animal Science.
http://pubs.nrc-cnrc.gc.ca/aic-journals/anicontents.html
This journal publishes original research on all aspects of domestic livestock and their products: cellular and molecular biology, animal biotechnology, application of technology, behavior and management, breeding and genetics, meats, pastures and forages, physiology, ruminant nutrition, non-ruminant nutrition.

Journal of Agricultural Education. American Association of Agricultural Education.
http://pubs.aged.tamu.edu/jae/
This journal publishes articles related to teaching and learning specific an agricultural setting. The site uses a search tool to browse the various available volumes.

Journal of Animal Breeding and Genetics. Blackwell Publishing.
www.blackwellpublishing.com/aims.asp?ref=0931-2668
The journal publishes original articles on theoretical and applied animal breeding and genetics by international scientists on the progress of research in animal production, Book reviews are also included and would interest researchers, teachers, and the animal breeding industry. A supplemental series *Advances in Animal Breeding and Genetics/Fortschritte in der Tierzüchtung und Züchtungsbiologie* is published at irregular intervals.

Journal of Animal Science. The American Society of Animal Science (JAS). jas.fass.org
This journal gives publication of original research in Genetics, Growth and Physiology, Nutrition, Production, Products, and Special Topics in animal production. Review articles related to animal science and animal science education (teaching and learning) are also available. JAS readers represent education, industry, and government, including research, teaching, administration, veterinary medicine, extension, management, quality assurance, product development, and technical services.

World's Poultry Science Journal. CABI Publishing.
http://gort.ucsd.edu/newjour/w/msg02529.html
World's Poultry Science Journal is a quarterly peer reviewed scientific journal for academics, researchers, students, extension workers and commercial poultry producers and provides an international forum for the exchange and dissemination of information on poultry science including research, education and industry organization.

Table 7: Journal articles relevant to teaching animal science

Kauffman, R. G., J. F. Thompson, D. B. Anderson, and R. E. Smith. 1971. Improving the effectiveness of teaching animal science. Journal of Animal Science. 32:161–164.	The paper identifies techniques that will be helpful in improving effectiveness of teaching. These practices supplement the information given to students in the class. They include activities that seem to restrict or require extra effort on the teacher and/ or the students.
Kauffman, R. G. 1992. Modernizing the animal science curriculum: Is change needed? Journal of Animal Science. 70:2593–2596.	This author identifies various needs for the changes that should take place and do take place in the animal science curriculum. These he suggested should go alongside student learning in order to achieve progress.
McGlone, J.J. 1993. Teaching Standard Agricultural Practices That Are Known to Be Painful. Journal of Animal Science 1993. 71:1071-1074	This article studies some the policies that exist in institutions with regards to practices that are necessary in animal production but are deemed painful that address the mode of teaching such methods.
Schillo, K. K. 1998. Toward a Pluralistic Animal Science: Post liberal Feminist Perspectives. Journal of Animal Science. 76:2763-2770.	This article tries to foster a more diversified animal science community through creating a balance between identity and professionalism in the animal science community using a feminist environment.
Torres, R.M. and Cano, J. 2000. Learning Styles of Students in a College of Agriculture. Journal of Agricultural Education. 35:61-66	The study focused on identifying the preferred learning styles of student in an agricultural institution. The authors also suggest incorporation of teaching styles that will enhance student learning.
Schillo, K. K. 2002. Teaching Animal Science: Education or Indoctrination? Journal of Animal Science.75: 950-953.	This article tries to evaluate the method of teaching animal science to students. The author proffers a method that will enhance critical thinking by students rather than imbuing them with information without learning taking place.

Hasebrook and Gremm (1999) in their study did not find any significant influence of video in an experiment on information recall by students. They go on to conclude that learning gains come from instructional styles of the instructors. Such information contrasts with the reports of Passalacqua and Klein (2003) which indicates a significant improvement in academic performance of students with the incorporation of a CD-ROM in the anatomy and physiology laboratory classes. Stokes (2002) in her review concludes that positive results emanate from the use of visual aids in teaching and learning. She however, stresses the need for teaching skills and techniques in the language of imagery for effective use of visual enhancements.

Inadequacy or lack of facilities for teaching some topics in animal genetics makes it more difficult to be learnt. Although the students may actually reproduce what has been taught in the class, learning may not have taken place. Visuals may be regarded as an alternative to hands-on

Table 8: Educational material providers and internet resource sites

Insight Media
http://www.insight-media.com/All_home.htm
This company provides a wide range of educational videos on DVD, CD-ROM and VHS. They cover a wide spectrum of topics in genetics including biotechnology, quantitative genetics and molecular genetics. The materials are very useful for instructors as well as students in the understanding of animal genetics.

Animal Health and Production Compendium- 2005 Edition. CABI Publishing.
(www.cabiscompendium.org/ahpc)
The Compendium is a time-saving, encyclopedic, interactive database that draws together scientific information on all aspects of animal health and production. Areas covered in the software include diseases, breeds, nutrition, husbandry and treatment of livestock and poultry. It is also available on CD-ROM and internet.

Geisert, R. Learning Reproduction in Farm Animals.
http://animalsciences.missouri.edu/reprod/
This instructional material is intended for undergraduate education and contains lecture notes and visual aids. It addresses various topics in reproduction as it relates to farm animals among which include anatomy and physiology, sex determination and development, endocrinology, etc. The student version can be obtained online at no cost. The instructor version is also available on CD in Microsoft PowerPoint format.

Feathersite
www.feathersite.com
This is an on-line zoological garden of domestic poultry, including photos, video and information such about various breeds of fowl, such as chickens, ducks, geese, guinea fowl, peafowl, pigeons, and turkeys. Various wildfowl are also included. Information on production, sexing as well as books on poultry are available on the website.

Virtual Livestock Library
http://www.ansi.okstate.edu/library/
This site is owned by the Oklahoma State University. It contains pictures and information on different classes of livestock, academic and related information.

The Poultry Science Virtual Library
http://gallus.tamu.edu/library/dother.html
These include the academic information, discussion groups, market information, software and online journals related to the poultry industry. Web and gopher resources are listed. The visual aids and pictures encourage student understanding and learning.

experience in order to foster learning; however they are best used as a supplement. The use of such material seems to add a "learning advantage" without eliciting negative attitudes from students on instruction (Pascarella and Teuscher, 1998). Table 8 shows a list of some providers of educational videos and other media as well as some resource internet sites either directly or indirectly pertinent to the field of teaching animal genetics and breeding.

Cartoons

This involves the use and incorporation of appropriate graphic humor in the instruction

process as well as in lecture materials. This gives a different approach to teaching by providing an entertaining and relaxed atmosphere for students which promotes learning. Some of its merits especially in the class include reduction of anxiety, stress and boredom, building confidence, improving productivity, and encourages divergent thinking (Ziegler, 1998). A study on student use of humor and retention of lecture material among student athletes has provided outcomes that could be generalized to all students. This is due to the enhanced cognitive abilities of the students when used appropriately (Williams, 2001). The author concludes that the use of humor in form of comics, cartoons, etc., actually increases the retention of lecture materials in students than the use of only strict lecture format. The use of this valuable teaching tool (Kher *et al.*, 1999) has attributes that will increase enthusiasm for a subject. Some content-related cartoon sites are listed below.

a. ***Animal Experiment Cartoons.***
www.cartoonstock.com/directory/a/animal_experiment.asp

b. ***Animal cartoons***
www.andertoons.com/animal_cartoons.php

c. ***Animal Cartoons by Randy Glasbergen***
www.borg.com/~rjgtoons/fun.html

d. ***Education Cartoons for Teachers by Randy Glasbergen***www.borg.com/~rjgtoons/edu.html

e. ***Vegetarian Cartoons***
www.vegetus.org/vegtoon/vegtoon.html

Teaching Workshops

Teaching workshops are part of teaching improvement programs (Wilkerson and Irby, 1998) and are organized by units within the academic institution with the sole aim of improving methodologies employed in teaching. A comprehensive faculty development program should include professional development, instructional development, leadership development and organizational development. Table 9 contains some workshops organized by the University of Manitoba Teaching Services for new faculty and graduate students who have the intent of going into the academe. These workshops are selected to address needs and probable difficulties new faculty members may encounter. Even though these specific workshops may not be available to the public, readers are encouraged to find similar support at their institutions from the Education Faculties and/or Teaching Services centers. There is also the possibility of gaining access to these teaching workshops through the internet through distance delivery.

Teaching Assessment

Finally, this is a crucial component of teaching which provides a platform for participation of the students and the teacher as well. Teaching assessment may be a tool for improvement in the process of handling a class of genetics and animal breeding. It creates an avenue of empowering students to contribute to teaching standards and techniques. It is not an avenue of condemning teachers but to offer a valuable critique of their mode of teaching that will assist them to modify their teaching techniques to suit their students' learning process. It enables teachers to understand the student needs and their preferences and also to incorporate other teaching techniques in the classroom.

Table 9: A list of possible teaching workshops.

Teaching Techniques	This workshop provides an intimate and supportive environment for participants to learn and practice lecturing, demonstration and discussion styles in teaching. Students are asked to prepare a brief exposition and are video-taped by the instructor. The teacher and peers give verbal feedback to the student. The taped section is very helpful to watch oneself teach, observing for mannerisms, body language and bridging sentences and ideas together is valuable. This workshop is necessary for new faculty to demonstrate their skills and to learn new ones.
Teaching with Technologies	This workshop offers a hands on approach as students break into groups and then gather as a large group to discuss current technologies. Several current and relevant handouts are distributed which address Bloom's taxonomy, Gagne's instructional events, corresponding cognitive processes, PowerPoint advantages and disadvantages, along with tips and methods to enhance or strive for excellence in online courses.
Creating Effective Syllabi	This workshop presents an abundance of tips to assist new faculty with the creation of a course syllabus. An example is shared which allows for discussion. Specific guidelines and suggestions for creativity are discussed.

Steadman (1998) enumerated a number of advantages of teaching assessment to both teachers and students. The first advantage for teachers is the increased collaboration and communication between teachers and students. By giving the students a voice in the class, they are able to express their feelings towards a teaching style or use of a teaching component. The students also have the feeling that the teacher cares about their welfare and understanding of the subject in the class. The teacher on the other hand should be able to accept a criticism on any aspect of the teaching since it is the reason for the inclusion of such components in teaching. In addition, teachers would also have the ability to handle classroom activities such as incivilities which may occur in the class. Getting feedback from students will assist in incorporating their suggestions on the appropriate measures for disciplining erring students. By so doing, teachers are able to modify their teaching styles based on feedback they receive from students. Students also have increased interest in understanding the materials taught.

Conclusion:

The above items refer to resources that are available to instructors and students towards fostering a better teaching and learning environment. The teaching resources facilitate the process of teaching for prospective, new and veteran teachers. The incorporation and identification of more teaching materials goes a long way to improving the scholarship of teaching especially as it applies to each learning environment. There is need to organize teaching workshops for graduate students, new and veteran teachers in order to accommodate the dynamics of education. All these will improve

the quality of teaching and learning especially in our tertiary institutions.

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Hasebrook, J. P. and **Gremm, M.** (1999) Multimedia for vocational guidance: Effects of individualized testing, videos, and photography on acceptance and recall. *Journal of Educational Multimedia and Hypermedia*. 8:377-400.

Kher, N., Molstad, S. and **Donahue, R.** (1999). Using humor in the college classroom to enhance teaching effectiveness in "dread courses". College Student Journal.

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