

Curriculum Evaluation of the Science Applications in Agriculture Courses Final Report

FY 02-Post Secondary Mini-Research Projects--Agricultural Education

Prepared by:
Jeff Moss and Mindy Porter
Department of Human & Community Development
University of Illinois
151 Bevier Hall
905 S. Goodwin Ave
Urbana, IL 61801

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Curriculum Evaluation of the Science Applications in Agriculture (BSAA, PSAA) Courses

Illinois is a leading state in the development and implementation of agriscience instruction. Four, one-semester Science Applications in Agriculture (SAA) courses were developed at the University of Illinois from 1990-1994. These included two semesters in Biological Science Applications in Agriculture (Plant and Animal Science), and two semesters in Physical Science Applications in Agriculture. These courses were designed to teach science as both content and process by integrating science concepts and principles with specific applications/practices in agriculture. Experiments have served as the predominant teaching method in the lab-based courses. The curriculum for each SAA course was developed in the format of a Teacher's Guide initially, then textbooks for Biological Science Applications in Agriculture and Physical Science Applications in Agriculture were later published by Interstate Publishers in 1994 and 1996.

Implementation of the Science Applications in Agriculture curricula has resulted in the integration of more science concepts being taught in the agriculture classroom. Science credit is earned upon completion of BSAA/PSAA courses in many school districts across Illinois. With the approval of science credit for these courses comes an increased accountability for agriculture programs to meet State Learning Standards in Science. Consequently, evaluation of the lesson activities in the Science Applications in Agriculture curricula needed to be conducted to assure lessons are optimally aligned with the new State Learning Standards. Additionally, lessons that are not being utilized by teachers should be identified and replacement lessons or procedures suggested that would better suit teacher/student needs to ensure that the Science Applications in Agriculture courses address the Illinois State Learning Standards in Science.

Before an accurate revision of the BSAA/PSAA lessons can be conducted, input on the usage and satisfaction with current lessons needed to be collected from agriculture teachers throughout the state of Illinois. The focus of this project was to develop an evaluation survey, distribute it to high school agriculture programs teaching BSAA/PSAA, and compile the results. This project also utilized previously identified learning standards addressed by each lesson in the BSAA/PSAA courses to examine if any concepts from the revised Illinois Learning Standards are omitted in the curricula.

Objectives of the project were:

1. Identify the extent to which lessons in the BSAA & PSAA curricula are being utilized by educators and collect information for suggested revisions to the existing lessons.
2. Identify the extent to which the BSAA and PSAA textbooks are being used and collect information for suggested revisions.
3. Identify topics for new lessons in the BSAA/PSAA curricula which address State Learning Standards in Science.
4. Review current Learning Standards addressed by the existing BSAA/PSAA curricula for adequacy in achieving state standards.
5. Identify a minimum of three web-based teaching resources for existing and future lessons in the BSAA/PSAA curricula.

Procedures to accomplish the objectives were as follows:

1. Developed and distributed a survey to Illinois agriculture teachers offering the BSAA/PSAA curricula, which provided the baseline information for the revision process.
2. Compiled survey results and prepared suggested revisions to the existing BSAA/PSAA lessons.

The following additional procedures will be conducted during the 2002-2003 school year due to the limited responses to the web-based survey.

3. Identify an expert panel of 10-12 agriculture instructors to review suggested revisions to the curricula.
4. Compile recommendations from the expert panel and prepare a revision plan to include the development of new lessons for the BSAA & PSAA courses.
5. Compile a matrix of State Learning Standards that would be addressed by the BSAA/PSAA curricula upon implementation of the revision.
6. Compile a list of web-based teaching resources for each lesson in the revision plan.

Results for the Biological Science in Agriculture – Plant Science Survey

Evaluation data for the BSAA – Plant and Animal Science courses were collected from 16 schools representing 10 different IAVAT sections. All 16 schools reported that students received science credit for participation in the class. Ten of the 16 schools were offering BSAA as a stand alone course during the 2002-2003 school year. School participation by IAVAT section is listed in Table 1.

Table 1. Number of respondents by IAVAT Section

IAVAT Section	Number of Respondents
1	1
2	2
6	1
11	1
12	1
13	3
14	1
16	3
23	2
25	1

Respondents reported which lessons were taught in their program for each of the 35 lessons in the BSAA – Plant Science Curriculum. The frequency of lessons used ranged from a high of 96% for Unit I lessons to a low of 47% for Unit VII lessons. The frequency of lessons used by Unit for the BSAA – Plant Science curriculum is shown in Table 2.

Table 2. Percentage of lessons taught by Instructional Unit for BSAA – Plant Science.

Instructional Unit	Percent of lessons taught
Unit I: Conducting Scientific Investigation in Agriculture	96%
Unit II: Agriculture and the Environment	81%
Unit III: Managing Inputs for Plant Growth	80%
Unit IV: Initiating Plant Growth	73%
Unit V: Managing Plant Growth	68%
Unit VI: Reproduction in Plants	60%
Unit VII: Handling, Storing and Processing Plant Products	47%

The most frequently taught lesson in BSAA – Plant Science is Using Scientific Measurement taught by 100% of the respondents. The least frequently taught lesson was Minimum Tillage taught by only 38% of the respondents. Five of the six lessons in Unit VII were taught in less than 50 percent of the programs reporting in this study. In general, the percent of lessons taught declined from Unit I at the beginning of the curriculum to Unit VII at the end of the curriculum. Respondents also reported for the lessons they taught, which lessons helped to meet State Learning Standards. The percentage of lessons by Unit which are reported as helping to meet State Learning Standards is described in Table 3.

Table 3. Percentage of lessons by Unit contributing to State Learning Standards

Instructional Unit	Percent of lessons
Unit I: Conducting Scientific Investigation in Agriculture	72%
Unit II: Agriculture and the Environment	56%
Unit III: Managing Inputs for Plant Growth	29%
Unit IV: Initiating Plant Growth	46%
Unit V: Managing Plant Growth	54%
Unit VI: Reproduction in Plants	59%
Unit VII: Handling, Storing and Processing Plant Products	64%

The lessons in Unit I: Conducting Scientific Investigation in Agriculture are seen as contributing the most to the State Learning Standards (72%) while the lessons in Unit III are reported to be contributing the least (29%) to the State Learning Standards. Overall, the respondents see a majority of the lessons in each unit (with the exception of Unit III) as contributing to the State Learning Standards. Data were also collected as to whether the lessons in the BSAA – Plant Science curriculum address relevant subject matter. Results were higher in this category than for the category, helps meet State Learning Standards. The percentage of lessons by Unit in the BSAA- Plant Science curriculum which are considered to address relevant subject matter is reported in Table 4.

Table 4. Percentage of lessons by Unit addressing relevant subject matter

Instructional Unit	Percent of lessons
Unit I: Conducting Scientific Investigation in Agriculture	72%
Unit II: Agriculture and the Environment	74%
Unit III: Managing Inputs for Plant Growth	75%
Unit IV: Initiating Plant Growth	63%
Unit V: Managing Plant Growth	77%
Unit VI: Reproduction in Plants	76%
Unit VII: Handling, Storing and Processing Plant Products	69%

In general, nearly three-fourths of the lessons in the Units are perceived as possessing relevant subject matter. Each lesson in the BSAA – Plant Science curriculum was also rated as to its ease of use. The rating scale was 1= excellent, 2= good, 3= average, 4= below average and 5= poor. The respondents ranked the lessons in Unit VII: Handling, Storing and Processing Plant products as the easiest to use with a combined rating for all lessons in this unit equal to 1.60, between excellent and good. The lessons in Units V and VI were ranked the most difficult with a combined rating of 2.22, good and average, for each Unit. The most difficult rated lesson was the Tissue Culture lesson in Unit VI which was rated as 3.16 or average. Overall, the lessons are

not rated as too difficult for ease of use with all ratings falling near average or below. The ratings for ease of use for each of the Units in the BSAA – Plant Science curriculum are reported in Table 5.

Table 5. Ease of use for lessons by Unit of instruction in BSAA – Plant Science

Instructional Unit	Mean rating
Unit I: Conducting Scientific Investigation in Agriculture	1.95
Unit II: Agriculture and the Environment	2.08
Unit III: Managing Inputs for Plant Growth	2.13
Unit IV: Initiating Plant Growth	1.62
Unit V: Managing Plant Growth	2.22
Unit VI: Reproduction in Plants	2.22
Unit VII: Handling, Storing and Processing Plant Products	1.60

1= excellent, 2= good, 3= average, 4= below average and 5= poor.

Respondents also rated the content of the lessons in the BSAA – Plant Science Curriculum using the same rating scale for Ease of Use. Lessons in Unit IV were judged to contain the best content with an overall mean rating of 1.55, between good and excellent. The lessons in Unit III were rated the lowest according to content with an overall mean of 2.42, between good and average. A summary of the mean ratings for content is presented in Table 6.

Table 6. Rating of lesson content by Unit of instruction in BSAA – Plant Science

Instructional Unit	Mean rating
Unit I: Conducting Scientific Investigation in Agriculture	2.35
Unit II: Agriculture and the Environment	2.24
Unit III: Managing Inputs for Plant Growth	2.42
Unit IV: Initiating Plant Growth	1.55
Unit V: Managing Plant Growth	2.28
Unit VI: Reproduction in Plants	1.96
Unit VII: Handling, Storing and Processing Plant Products	1.84

1= excellent, 2= good, 3= average, 4= below average and 5= poor.

Instructor comments were also solicited in this study and offered insight into suggested revisions for future editions of the curriculum. Respondents identified 1) most successful lessons, 2) least successful lessons, 3) titles of additional lessons, 4) suggestions for changes, 5) improvements

for textbook, 6) improvements for Teachers Guide, and 7) suggested professional development activities. The following generalizations were made based on the respondent comments.

- 1) No specific lessons were consistently identified as most successful.
- 2) Unit VII lessons are perceived as less successful than the other Units and the herbicide labs were less successful.
- 3) Biotechnology lessons were most frequently cited as additional lessons incorporated into the curriculum.
- 4) More lab activities were the most frequently cited suggestion for change.
- 5) The textbook should follow the Teacher’s Guide more closely.
- 6) The Teacher’s Guide should match the textbook more closely.
- 7) Perform the experiments at workshops.

Results for the Biological Science in Agriculture – Animal Science Survey

Respondents reported which lessons were taught in their program for each of the 30 lessons in the BSAA – Animal Science Curriculum. The frequency of lessons used ranged from a high of 86% for Unit I lessons to a low of 27% for Unit V lessons. The frequency of lessons used by Unit for the BSAA – Animal Science curriculum is shown in Table 7.

Table 7. Percentage of lessons taught by Instructional Unit for BSAA – Animal Science.

Instructional Unit	Percent of lessons taught
Unit I: Scientific Investigations in Agriculture	86%
Unit II: Animal Genetics and Biotechnology	87%
Unit III: Growth and Development of Animals	56%
Unit IV: Animal Reproduction	69%
Unit V: Aquaculture	27%
Unit VI: Processing Animal Products	41%

The most frequently taught lesson in BSAA – Animal Science is Exploring Research Methods in Agriculture taught by 100% of the respondents. The least frequently taught lessons were Effect of Temperature in Cold-Blooded Animals and Microbial Cycling of Nitrogen taught by only

25% of the respondents. All three of the lessons in Unit V: Aquaculture were taught in less than 30 percent of the programs reporting in this study. Respondents also reported for the lessons they taught, which lessons helped to meet State Learning Standards. The percentage of lessons by Unit which are reported as helping to meet State Learning Standards is described in Table 8.

Table 8. Percentage of lessons taught contributing to State Learning Standards

Instructional Unit	Percent of lessons
Unit I: Scientific Investigations in Agriculture	76%
Unit II: Animal Genetics and Biotechnology	57%
Unit III: Growth and Development of Animals	49%
Unit IV: Animal Reproduction	50%
Unit V: Aquaculture	38%
Unit VI: Processing Animal Products	50%

The lessons in Unit I: Scientific Investigations in Agriculture are seen as contributing the most to the State Learning Standards (76%) while the lessons in Unit V: Aquaculture are reported to be contributing the least (38%) to the State Learning Standards. Overall, the respondents see a majority of the lessons in each unit (with the exception of Unit V) as contributing to the State Learning Standards. Data were also collected as to whether the lessons in the BSAA – Animal Science curriculum address relevant subject matter. Results were higher in this category than for the category, helps meet State Learning Standards. The percentage of lessons by Unit in the BSAA- Animal Science curriculum which are considered to address relevant subject matter is reported in Table 9.

Table 9. Percentage of lessons by Unit addressing relevant subject matter

Instructional Unit	Percent of lessons
Unit I: Scientific Investigations in Agriculture	62%
Unit II: Animal Genetics and Biotechnology	75%
Unit III: Growth and Development of Animals	77%
Unit IV: Animal Reproduction	73%
Unit V: Aquaculture	77%
Unit VI: Processing Animal Products	67%

In general, nearly three-fourths of the lessons in the Units are perceived as possessing relevant subject matter. Each lesson in the BSAA – Animal Science curriculum was also rated as to its ease of use. The rating scale was 1= excellent, 2= good, 3= average, 4= below average and 5= poor. The respondents ranked the lessons in Unit I: Scientific Investigations in Agriculture as the easiest to use with a combined rating for all lessons in this unit equal to 1.94, between excellent and good. The lessons in Unit IV were ranked the most difficult with a combined rating of 2.75, between good and average. The most difficult rated lesson was the Artificial Insemination lesson in Unit IV which was rated as 2.81 or near average. Overall, the lessons are not rated as too difficult for ease of use with all ratings falling near average or below. The ratings for ease of use for each of the Units in the BSAA – Animal Science curriculum are reported in Table 10.

Table 10. Ease of use for lessons by Unit of instruction in BSAA – Animal Science

Instructional Unit	Mean rating
Unit I: Scientific Investigations in Agriculture	1.94
Unit II: Animal Genetics and Biotechnology	2.60
Unit III: Growth and Development of Animals	2.25
Unit IV: Animal Reproduction	2.75
Unit V: Aquaculture	2.63
Unit VI: Processing Animal Products	2.10

1= excellent, 2= good, 3= average, 4= below average and 5= poor.

Respondents also rated the content of the lessons in the BSAA – Animal Science Curriculum using the same rating scale for Ease of Use. Lessons in Units I and IV were judged to contain the best content with an overall mean rating of 2.09 and 2.10, signifying good. The lessons in Unit II were rated the lowest according to content with an overall mean of 2.84, near average. A summary of the mean ratings for content is presented in Table 11.

Table 11. Rating of lesson content by Unit of instruction in BSAA – Animal Science

Instructional Unit	Mean rating
Unit I: Scientific Investigations in Agriculture	2.09
Unit II: Animal Genetics and Biotechnology	2.84
Unit III: Growth and Development of Animals	2.55
Unit IV: Animal Reproduction	2.10
Unit V: Aquaculture	2.33
Unit VI: Processing Animal Products	2.43

1= excellent, 2= good, 3= average, 4= below average and 5= poor.

Instructor comments were also solicited in this study and offered insight into suggested revisions for future editions of the curriculum. Respondents identified 1) most successful lessons, 2) least successful lessons, 3) titles of additional lessons, 4) suggestions for changes, 5) improvements for textbook, 6) improvements for Teachers Guide, and 7) suggested professional development activities. The following generalizations were made based on the respondent comments.

- 1) The lessons on nutrition topics were identified as most successful.
- 2) No specific lessons were consistently identified as least successful. It was pointed out by one respondent that the Animal Behavior lab may violate current State Board of Education guidelines.
- 3) Genetics lessons were most frequently cited as additional lessons incorporated into the curriculum.
- 4) More lab activities were the most frequently cited suggestion for change.
- 5) The textbook should follow the Teacher’s Guide more closely.
- 6) The Teacher’s Guide should match the textbook more closely.
- 7) Perform the experiments at workshops.

Results for the PSAA Curriculum Survey

Only four schools responded to the PSAA curriculum survey and thus the data was too small for proper analyses. It is suggested that information for revision of the PSAA curricula be collected from focus groups of teachers who currently teach the course.

Conclusions

In summary, the respondents were in agreement that changes to the BSAA/PSAA curricula are warranted. Specifically, new lessons in the areas of genetics and biotechnology are needed. It is recommended that when current textbooks for BSAA and PSAA are revised that the texts more closely follow the information in the Teacher's Guides. It is further recommended that focus groups of teachers who are currently teaching BSAA/PSAA be convened during the 2002-2003 school year to further clarify necessary modifications to the curriculum.