# Assessing the Impact of NSF Leadership Workshops in Human Genetics and Bioethical Decision-Making: Personal Interviews as a Means of Validating Survey Data

An Honors Thesis (ID 499)
by
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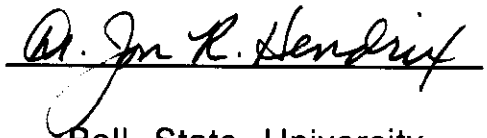

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Biological sciences continue to make remarkable discoveries and beneficial advances, through applying the use of current technology. One subdiscipline of biology, human genetics has shown tremendous growth. Everyday new discoveries are revealed and, when applied, raise moral and ethical questions. Questions like:

> Ought we screen *in utero* for any genetic disease for which there is no treatment? Ought we change the evolutionary destiny of any organism? Do we have the wisdom to control the hereditary material of all life? Ought we assume the role of co-creator (Hendrix 1988).

The public needs decision making skills and to be biological literate in order to confront and formulate solutions to these thorny issues. Thus the general populace needs to be able to: 1) comprehend the implications of current research, and 2) assess the consequences of applying these advances. For many individuals, the last formal opportunity to study genetics is in high school. Therefore, high schools should expose the students to the advances taking place in human genetics and should help students develop skills needed to assess the impact of using this powerful knowledge base.

Hurd (et al, 1980) concurs when he stated that: "The future goal of biological knowledge will place fundamental concepts in a socially relevant and personally meaningful context for students." Furthermore, Hurd (et al., 1980) believes that science and societal issues needs to be an integral part of the biology curriculum at the high school level so that preparation for participatory citizenship is addressed.

In 1977, a workshop was developed by Drs. Jon R. Hendrix and Thomas R. Mertens to help teachers address: "Two specific areas of biology, human genetics and bioethical decision-making" (While et al. 1987). They obtained funding from the National Science Foundation (NSF) and in the summer of 1978, forty teachers from the state of Indiana participated in a four-week workshop at Ball State University. Teachers applied their new knowledge by developing instructional strategies for secondary school classrooms. Extensive follow-up and visitational components were intrinsic to the evaluational model used to assess the impact of the project. The workshop was held again in 1979, and has been updated and repeated for each of the following years; 1980, '81, '84, '85, '86, and '88. The workshops' participants in 1979, '80, '81, '84 were from states east of the Mississippi River. Participants for subsequent years were drawn from a nationwide population of outstanding biology teachers. In 1985, a network of former participants, The National Network to Implement Human

Genetics And Bioethical Decision Making into Secondary School Biology Classrooms, was established. Currently, the Network consists of over 250 former participants of the workshops.

In 1983-84 for her doctoral studies, Dr. Margaret While researched the impact of the 1978, '79, '80, '81 workshops (While 1984). A criterion group was selected which consisted of the participants of the workshops in 1978, '79, '80, and '81. A control group was established which consisted of teachers who matched the criterion group in age, gender, type of geographical location of the school, and number of years of teaching experience. Dr. While developed a research survey instrument which sought data concerning the teaching of human genetics and bioethical decision-making in the classes of both the criterion and reference teachers. The data were collected, analyzed, and reported in her dissertation (While 1983).

During the 1988-89 school year, the author duplicated Dr. While's research with participants from the 1984, '85, '86, and '88 projects. Workshop participants in Dr. While's group formed the reference group for the current study. A slightly modified form of Dr. While's research instrument (Appendix A) was mailed to 155 participants from the 1984, '85, '86, and '88 workshops. The 1988 workshop participants were remailed the survey in 1989. This remailing was done to allow them time to implement programs learned at the workshops. Since these latter workshops('84-'88) consisted of recognized teacher-leaders, the researcher was especially interested in assessing the impact of these workshops as compared to the impact of the earlier workshops. Respondents to the current survey instrument formed the criterion group.

A cross validation study of the data obtained from the current survey was done by personally interviewing , twenty-two workshop participants from the criterion group who were in attendance at the 1988 National Association of Biology Teachers (NABT) Convention in Chicago, Illinois. The author obtained an undergraduate research grant from Ball State University to fund the traveling expenses to attend the 50th annual NABT conference where the interviews were conducted. These data were used to assess the validity of the data obtained from the returned, research survey instruments.

## Background Literature

Since 1950, biology has been established as an important high school science course (Yager, 1982). Biology courses of the 1950s usually focused on the application of basic science (Yager, 1982). Five goals were outlined in a retrospective study of biological education: 1) biological knowledge, 2) scientific methods, 3) social issues, 4) personal needs, and 5) career preparation (Hurd et al., 1980). The goal of biological knowledge ranked first with the teachers in the 1950s and the social goal ranked last (Hurd et al. 1980). The high school biology teachers of the 1950s seem to be concerned with teaching their students the basic facts, theories and principles of science.

The 1960s gave science education a major boost. The Russian launching of Sputnik provided a shock to public attitudes and national science policy (Brinckerhoff 1985). Many scientific organizations were established or, if already established were generously funded. The National Science Foundation was given $1.5 million of public funds to develop new projects for science curricula and out of these monies came the "formation of the Biological Sciences Curriculum Study (BSCS) in 1959" (Yager, 1982). The goal of biological knowledge remained important in the 1960s, while the goal for social issues was raised to the fourth most important goal of the five previously mentioned. The field of biological education was changing but was not yet addressing social or personal needs.

After a time of disillusionment, science education's impact was reassessed via the major studies of the 1970s. These studies consisted of 1) Accomplishments and Needs in Science Education Study funded by the National Science Teachers Association (NSTA 1978), 2) Project Synthesis conducted by Norris Harms of the University of Colorado (Harms 1977), 3) the Helgeson, Blosser, and Howe study at Ohio State University (Helgeson, Blosser, and Howe, 1977), 4) Iris Weiss, Research Triangle Institute study (Weiss, 1978), and 5) the Stake and Easley study (Stake and Easley, 1978). Never has so much information been gathered on the field of science education as was collected in these few short years. It was during this time that the five major goals of biological education were evaluated. Hurd et al. (1980) formulated specific directions for updating the biology curriculum. They stated that biological knowledge should remain an important goal of biology education and that biology educators, "...should place fundamental concepts in a socially relevant and personally meaningful context for students" (Hurd et al. 1980). However, it was emphasized that obtaining biological concepts pertaining to personal and

societal needs be the primary goal of biology education. "Human biology with an attendant stress on the person as an individual in a society should be the organizational theme of biology education" (Hurd et al., 1980).

During this time of reassessment, the thesis director, Dr. Jon R. Hendrix, and his colleague, Dr. Thomas R. Mertens, conducted state and national studies on the status of biological education. One of their major research projects was the assessment of "...the stances of the teachers with respect to a variety of these science/society issues." (Mertens et al., 1979) They also completed research dealing with bioethics courses in universities (Hendrix, 1977) and textbooks used in the biology classroom (Boschmann et al., 1978). Data from their research was used to help develop educational materials and programs designed to meet the needs of the teachers they surveyed (Mertens et al., 1979). As an example, a workshop was designed "...to prepare its participants to teach principles of genetics using human examples and to deal with bioethical issues resulting from applying new knowledge and technology in human genetics"(Mertens and Hendrix 1988). It is these workshops which were assessed by Dr. While in 1983-84 and the author in 1988-89.

**Methods**

The replication of Dr. While's study was conducted during the 1988-89 academic year. A survey instrument which was a slightly modified form of the instrument developed by Dr. While in her 1983-84 work was employed (Appendix A). The modification of While's instrument was a change of the calender year was made in item number 5. The survey consisted of four pages, designed to be clear and easy to answer. The first page and a half sought data on background information of respondees. For example, these items sought data on "gender, teaching environment, experience, and professional training" (While et al., 1987). The rest of the survey included items keyed to the coverage of human genetics and bioethics in the participants' classrooms. Item number nine pertained to the types of biological science classes offered in the high schools. Item 11a and 11b sought data concerning the amount of time spent on genetics and human genetics in the teachers classroom. Specific examples, human and non-human, used by the participants and the methods employed when teaching was the topic for item 11c. Item 12 was divided into to six subunits, each unit related a different teaching modality for bioethics in the classrooms of the workshop participants.

The survey was mailed to the 155 participants (criterion group) of the workshops held during the summers of 1984, '85, '86, and '88 at Ball

State University. The survey was remailed to the 1988 participants in 1989 after they had time to implement what they had learned in the workshop. Participants from the last three workshops('85-'88) had been chosen from applications received from a nationwide sample. The reference group for the current study was comprised of the criterion group from Dr. While's study, who were participants in the 1978, '79, '80, and '81 workshops.

Research was also conducted at the 50th annual National Association of Biology Teachers (NABT) conference held in Chicago, Illinois. Personal interviews were conducted with twenty-two of the workshop participants, with a standard interview survey instrument developed by the researcher which consisted of eight questions designed to assess items covered in the printed survey instrument (Appendix B). Each item on the interview instrument corresponded with a item found on the While's survey form. Questions 2, 3, and 4 related to item 11c on the survey instrument, and questions 5, 6, 7, and 8 related to item 12 on While's instrument.

The data obtained from the both the written survey instrument and the personal interview survey instrument were collected and entered in a data base using the Microsoft Works Version 2.0 database on an Apple Macintosh SE computer. Categories were labeled by the item from which they stemmed, then tabulated and percentages were calculated for the criterion group and personal interview group in each labeled category. Percentage tests were run and a z score obtained to test the null hypothesis that there would be no significant difference between the data from the reference group and the criterion group. With alpha level=0.05, the null hypothesis is rejected when $z > 1.645$, and with alpha=0.01 the null hypothesis is rejected when $z > 2.33$.

## Results

Of the 155 surveys mailed to the criterion group, 117(75.48%) were returned. This return rate was 7.94% greater than the return rate obtained by Dr. While in the reference survey. The criterion group consisted of 73 males and 44 females while the reference group consisted of 56 males and 21 females (See Table 1).

Table 1
Sexes of teachers

| Sex | Reference Group ('79-'81) | Criterion Group ('84-'88) |
|---|---|---|
| Male | 72.7% | 62.1% |
| Female | 27.3% | 37.9% |

Item 3a of the survey instrument sought information on the grade levels taught by the teachers. The majority of the reference group taught at the 9th and 10th grade levels while the criterion group showed a majority teaching at the 10th, 11th, and 12th grade levels. A dramatic drop in the percentages of 7th and 8th grade levels taught between the reference and criterion group was also seen (See Table 2). This shift in the grade levels taught may account for some of the differences observed between the reference and criterion group.

Table 2
Teaching Assignment by Grade of
Reference group and Criterion

| Grade | Reference Group | Criterion Group |
|---|---|---|
| 7 | 14.7% | 3.7%** |
| 8 | 6.7 | 0.9* |
| 9 | 54.7 | 46.6 |
| 10 | 61.3 | 84.3** |
| 11 | 24.0 | 55.6** |
| 12 | 22.7 | 59.3** |

*Significant beyond the .05 level
**Significant beyond the .01 level

Item 3b sought data on the total number of students each teacher taught during the academic year. An increase was seen in the number of students taught by the criterion group compared to the reference group. The criterion group had a much higher percentage in the category of having 75 or more students than did the reference group (See Table 3). The difference was significant at the .05 level. These data may also reflect on the differences observed between criterion and reference groups when examining later items from the survey.

Table 3
Number of Students Instructed by
Reference Group and Criterion group

| Number of Students | Reference Group | Criterion Group |
|---|---|---|
| Less than 30 | 8.0% | 4.6% |
| 30-75 | 30.7 | 22.3 |
| More than 75 | 61.3 | 75.9* |

*Significant at the .05 level

The background experiences of the teachers in both groups remained very similar but some significant changes were seen between the two groups. The criterion group showed a lesser amount of formal education in the form of undergraduate or graduate courses taken (See Table 4). There was a significant difference between the reference and criterion groups with respect to those who had taken courses in advanced genetics and bioethics.

Table 4
Courses in Genetics and Bioethics Completed
by Reference Group and Criterion Group

| Course | Reference Group | Criterion Group |
|---|---|---|
| Genetics(General) | 96.1% | 94.8% |
| Advanced Genetics | 58.4 | 43.9* |
| Human Genetics | 92.2 | 96.6 |
| Bioethics | 92.2 | 84.4* |

*Significant at the .05 level
**Significant at the .01 level

A difference was also seen in the number of workshops or conferences other than the Ball State Workshop attended by members of the reference group as compared to the criterion group which was the focus of item 8 of the questionnaire (See Table 5). The criterion group showed lower percentages under each topic except human genetics and the differences were significant in the biosocial problems and issues and bioethical decision-making topics.

Table 5
Conferences and Workshops Attended by Members of Reference and Criterion Groups

| Conference or Workshop Topic | Reference Group | Criterion Group |
|---|---|---|
| Human Genetics | 89.6% | 93.1% |
| Birth Defects | 89.6 | 83.6 |
| Biosocial Problems & Issues | 81.8 | 66.4 |
| Bioethical Decision-Making | 90.9 | 87.1* |
| Teaching Controversial Issues | 76.6 | 74.1 |

*Significant at the .05 level
**Significant at the .01 level

Table 6 lists the textbooks used by the reference and criterion teachers. Holt's Modern Biology and Merrill's Biology:Living Systems were the most frequently used textbooks in both of the groups. Yet these are the only two textbooks that showed similar percentages of use between the two groups. The criterion group used a much greater range of textbooks than the reference group. The differences that are seen between the textbooks used by the two groups may be a result of the fact that the criterion group is teaching more upper level classes. The number of college textbooks seen on the list may also be a reflection of the criterion group teaching more upper level classes.

Table 6
Major Biology and Life Science Textbooks
Used by Survey Respondents

| Textbook Publisher-Title | Reference Group | Criterion Group |
|---|---|---|
| Holt - Modern Biology | 18.2% | 24.0 |
| Merrill - Biology:Living Systems | 16.9 | 18.0 |
| Harcourt Brace J. - Biology | 0.0 | 8.0 |
| D.C.Heath - BSCS (Blue) | 2.6 | 8.0 |
| Prentice-Hall - Biology | 0.0 | 8.0 |
| Scott Foresman - Biology | 16.9 | 8.0 |
| D.C. Heath - Biology | 0.0 | 6.0 |
| Rand McNally/Houghton - BSCS (Green) | 2.6 | 5.0 |
| Merrill - Biology:An Everyday Experience | 6.5 | 5.0 |
| *Saunders - Biology | 0.0 | 5.0 |
| *Allyn Bacon - Biology:An Inquiry into the Nature of Life | 0.0 | 4.0 |
| Holt - Living Things: An Intro. to Biology | 0.0 | 2.0 |
| *Worth - Biology | 0.0 | 1.0 |
| Merrill - Biology | 0.0 | 1.0 |
| Silver Burdette - Biology | 6.5 | 1.0 |
| Worth - Invitation to Biology | 0.0 | 1.0 |
| Addison Wesley - Biology | 0.0 | 1.0 |
| Holt - Life Science | 3.9 | 1.0 |
| Randall Hunt - Human Genetics | 0.0 | 1.0 |
| Harcourt Brace J. - BSCS (Yellow) | 2.6 | 1.0 |
| Merrill - Principles of Science | 0.0 | 1.0 |
| Cebco - Biology: The Study of Life | 0.0 | 1.0 |
| Mosby - Biology | 0.0 | 1.0 |
| MacMillan - Biology | 3.9 | 1.0 |
| *Wadsworth - Biology: The Unity and Diversity of Life | 0.0 | 1.0 |
| *Benjamin Cummings - Biology | 0.0 | 1.0 |
| Merrill - Focus on Science | 5.2 | 1.0 |
| *Brown - Inquiry into Life | 0.0 | 1.0 |

*Textbook was written for the collegiate level

Item 9 sought information on particular classes or courses taught by the participants (Table 7). The differences in percentages of the types of

classes taught remained non-significant between the reference and criterion groups. But, the duration of some classes increased in the criterion group. The biology and society class showed a 19.1% increase in the length of teaching time where as the human ecology class increased teaching time by a factor of 16.6%. The human biology and environmental studies classes also showed an increase in the length of teaching time, although the increase was not quite as great as the previous two types of classes. This increase in teaching time may be due to the fact that the teachers are addressing bioethical issues more often in these classes. It is interesting to note that although the criterion group teachers have not attended as many workshops or conferences, they are spending more on bioethics in the classroom. This may be caused by the impact of the workshops held at Ball State.

Table 7
Courses Taught by Subjects in the
Reference and Criterion Group Devoted
Exclusively to the Topics Listed

| Course | Reference | | Criterion | |
|---|---|---|---|---|
| Topic | Percent | Duration | Percent | Duration |
| Human Genetics | 19.5% | 8.1weeks | 26.2% | 13.3 weeks |
| Human Biology | 15.6 | 16.8 | 24.3 | 19.2 |
| Environmental Studies | 13.0 | 18.6 | 14.0 | 17.5 |
| Bioethics | 13.0 | 6.3 | 11.2 | 4.6 |
| Biology and Society | 3.9 | 7.0 | 8.4 | 13.4 |
| Human Ecology | 2.6 | 6.0 | 3.7 | 10.0 |

Items 11a and 11b sought data on the time being spent on genetics and human genetics instruction in the classrooms of the teachers (Tables 8 and 9). An increase was seen in the teaching time spent on regular genetics concepts in the criterion group. The criterion group spent a significantly (.05) more amount of time of the study of regular genetics. A significant (.05) increase was also seen in the study of human genetics.

Table 8
Number of Hours Devoted to Studying Genetics
in Biology and Life Science Classes

| Number Of Hours | Reference Group | Criterion Group |
|---|---|---|
| 3 to 4 | 2.6% | 0.0%* |
| 5 to 6 | 3.9 | 1.9 |
| 7 to 8 | 5.2 | 3.7 |
| 9 to 10 | 11.7 | 11.1 |
| 11 to 15 | 18.2 | 18.5 |
| 16 to 20 | 29.9 | 24.1 |
| More than 20 | 28.6 | 40.7* |

*Significant at the .05 level

Table 9
Number of Hours Devoted to Studying Human
Genetics in Biology and Life Science Classes

| Number Of Hours | Reference Group | Criterion Group |
|---|---|---|
| 1 | 1.3% | 0.0% |
| 2 | 13.0 | 1.9** |
| 3 to 5 | 20.8 | 19.4 |
| Over 5 | 64.9 | 78.7* |

Item 12 on the survey instrument asked the teachers about different types of teaching settings they use in their classrooms. This item was used by Dr. While to test several null hypotheses she had developed for her dissertation. However, these hypotheses are not relevant to this research. The researchers used item 12 to collect data concerning the teaching settings/methods employed by both criterion and reference teachers. Item 12 was divided into 6 subunits (Table 10). Each subunit relates to a different teaching setting used in the classrooms by the participants of both the reference and criterion groups. Analysis of these data revealed that the teaching settings/methods were being used very frequently by both of the groups. In Dr. While's study, no significant differences were seen in the teaching settings/methods used by teachers who had attended a workshop and teachers who had not attended a workshop, except in the category of integrating value theory and ethics into the participant's of

the workshop classrooms. The analysis of the current study's data also reveals that no significant differences existed between the reference and criterion groups with respect to teaching settings/methods used. The data from both studies suggests that social issues and bioethics are being emphasized in biology classrooms of the participants and that the level of emphasis is remaining constant or slightly increasing in the classrooms of the participants of the workshops held from 1984 to '88.

Table 10
Mean and Standard Deviation of
Reference and Criterion Groups
For Items in Survey item Number 12

| Question Item and Summary | Group | N | Mean | Standard Deviation |
|---|---|---|---|---|
| 12a Biology concepts used to interpret human concerns | Reference | 77 | 4.013 | 0.769 |
| | Criterion | 111 | 4.336 | 0.745 |
| 12b Instruct students in ways to make decisions | Reference | 77 | 3.532 | 0.736 |
| | Criterion | 111 | 3.865 | 0.780 |
| 12c Integrate value theory and ethics into program | Reference | 77 | 3.355 | 0.890 |
| | Criterion | 111 | 3.568 | 0.770 |
| 12d Issues arising from recent genetics advances are studied | Reference | 77 | 3.688 | 0.831 |
| | Criterion | 111 | 4.126 | 0.740 |
| 12e Outside resource personnel meet with classes | Reference | 77 | 2.182 | 0.98 |
| | Criterion | 111 | 2.306 | 0.810 |
| 12f Films, videotapes, and T.V. programs as instructional resources | Reference | 77 | 3.338 | 0.954 |
| | Criterion | 111 | 3.766 | 0.813 |

Item 11c on the questionnaire relates to four major topics in the field of genetics and how these topics are covered in the classrooms of the workshop participants. The item was also designed to test for any differences in the coverage of non-human examples and human examples between the reference and criterion groups. The coverage included the genetics topics of: 1) dominant and recessive traits, 2) sex-linked traits, 3) multiple allele systems, and 4) 2n chromosome variation. When comparisons were made between criterion and reference populations on the coverage of dominant and recessive traits, four were shown to be significantly different (Table 11). These four differences were: 1) an increase in the two groups for fruit flies as a textbook topic, 2) a decrease between the two groups for fruit flies as a lecture/discussion topic, 3) an increase between the two groups for free/attached ear lobes as laboratory investigation, and 4) a decrease between the two groups for cystic fibrosis as a lecture/discussion topic. Comparisons between the criterion and reference groups on the coverage of sex-linked traits showed only two significant differences: increases in the use of audio/visual resource subjects for both hemophilia and muscular dystrophy in the criterion group (Table 12). One significant difference was found as a decrease in the criterion group on A,B,O blood types as a laboratory investigation in the coverage of multiple allele systems (Table 13). And three significant differences were found in the coverage of 2n chromosome number variations (Table 14). These three difference were: 1) an increase in the criterion group for use of Down syndrome as a lecture discussion topic, 2)an increase in the criterion group for use of Down syndrome as a audio/visual resource subject, and 3) an increase between the two groups for use of Turner syndrome as a audio/visual resource subject.

A cross validation study to determine the validity of respondents data was conducted at the annual NABT conference in Chicago, IL in October, 1988. The study consisted of personal interviews of 22 teachers who had attended the workshop, who are members of the national Network and who had answered and returned the written survey instrument. Interview questions 5, 6, 7, and 8 (Appendix B) were intended to seek validation of item 12 on the written survey. These questions pertained to the types of teaching settings/methods used by the interview group. The criterion and interview group showed no significant differences in the useage of these teaching settings/methods except in the category of having outside speakers which was significant at the .01 level (Table 15).

This difference may have been caused by a sampling error. The same 22 out of 118 may not give proper representation of the entire group of participants.

Interview questions 2, 3, and 4 were intended to seek validation of item 11c on the written survey. These questions related to major topics in genetics and how they are addressed in the participant's of the interview classrooms. There were no differences between the criterion and interview groups (Table 16). These questions were designed as open-ended questions which gave teachers more room to expound, detailing how they covered these topics in genetics. Data analyzed from interview question 2 which related to dominant and recessive traits revealed that the teachers used examples listed on the written survey and also some other examples such as human eye color, polydactyl, and Huntington's disease. Data analyzed from question 3 revealed that the participants only used the examples for sex-linked traits that were listed on the written survey. Data from interview question 4, when analyzed, revealed ABO blood types is the major example used for teaching concepts about multiple allele systems.

Table 11

Percentage of Use of Four Major Methods for Teaching About the Inheritance of Dominant and Recessive Traits By Reference and Criterion Groups

| Dom./Rec. Trait Example | Group | Text book Topic | Lecture Discuss. Topic | Labo. Invest. | A.V. Resources Subject |
|---|---|---|---|---|---|
| Garden Pea | Reference | 89.6*% | 80.5**% | 13.0% | 28.6% |
| | Criterion | 78.6 | 64.7 | 13.7 | 45.2 |
| Fruit Fly | Reference | 64.9 | 62.3** | 28.6 | 24.7 |
| | Criterion | 57.2 | 41.0 | 28.2 | 21.3 |
| Free/attached ear lobes | Reference | 42.9 | 62.3 | 53.2* | 6.5 |
| | Criterion | 38.5 | 59.0 | 69.2 | 7.7 |
| PTC Tasting | Reference | 35.1 | 64.9 | 68.8 | 10.4 |
| | Criterion | 31.6 | 57.2 | 70.1 | 8.5 |
| Cystic fibrosis | Reference | 33.8 | 85.7 | 9.1 | 33.8 |
| | Criterion | 26.5 | 80.3 | 12.0 | 31.6 |
| Sickle cell anemia | Reference | 58.4 | 90.9* | 22.1 | 49.4 |
| | Criterion | 52.1 | 81.2 | 19.7 | 40.5 |
| Tay-Sachs disease | Reference | 36.4 | 85.7 | 11.7 | 40.3 |
| | Criterion | 36.8 | 79.5 | 12.0 | 31.6 |

*Significant at .05 level

**Significant at .01 level

Table 12
Percentage of Use of Four Major Methods
for Teaching About Sex-Linked Traits
by Reference and Criterion Groups

| Sex-Linked Trait Example | Group | Text-book Topic | Lecture Discuss. Topic | Labo. Invest. | A.V. Resource Subject |
|---|---|---|---|---|---|
| Fruit Fly | Reference | 63.6% | 55.8% | 27.3% | 15.6% |
| eye color | Criterion | 58.1 | 45.3 | 21.3 | 15.3 |
| Red-Green | Reference | 64.9 | 85.7 | 27.3 | 15.6 |
| color blind | Criterion | 65.8 | 78.6 | 32.5 | 24.8 |
| Hemophilia | Reference | 68.8 | 87.0 | 27.3 | 22.1* |
| | Criterion | 65.8 | 86.3 | 19.7 | 37.6 |
| Muscular | Reference | 27.3 | 68.8 | 7.8 | 14.3* |
| dystrophy | Criterion | 27.3 | 76.9 | 10.2 | 28.2 |

*Significant at .05 level

Table 13
Percentage of Use of Four Major Methods
for Teaching About Multiple Allele Systems
by Reference and Criterion Groups

| Multiple Allele Trait Topic | Group | Text-book Topic | Lecture Discuss. Topic | Labo. Invest. | A.V. Resource Subject |
|---|---|---|---|---|---|
| Rabbit | Reference | 35.1% | 33.8% | 9.1% | 3.9% |
| coat color | Criterion | 30.8 | 30.8 | 4.3 | 5.1 |
| A,B,O blood | Reference | 70.1 | 87.0 | 72.7* | 23.4 |
| groups | Criterion | 70.9 | 84.6 | 59.8 | 29.1 |

*Significant at .05 level

Table 14
Percentage of Use of Four Major Methods for Teaching About Variations From the 2N Chromosome Number by Reference and Criterion Groups

| 2N Chromosome Variation Example | Group | Text-book Topic | Lecture Discuss. Topic | Labo. Invest. | A.V. Resource Subject |
|---|---|---|---|---|---|
| Polyploid plants | Reference | 41.6% | 42.9% | 1.3%* | 5.2% |
| | Criterion | 40.2 | 46.2 | 5.1 | 6.0 |
| Down Syndrome | Reference | 68.8 | 93.5* | 18.2 | 31.2* |
| | Criterion | 60.7 | 83.8 | 26.5 | 47.0 |
| Turner Syndrome | Reference | 57.1 | 85.7 | 13.0 | 19.5* |
| | Criterion | 51.3 | 79.5 | 19.7 | 34.1 |

*Significant at .05 level
**Significant at .01 level

Table 15
Teaching Settings Used by Criterion and Interview Groups

| Teaching Setting | Criterion Group | Interview Group |
|---|---|---|
| Biology concepts used to interpret human concerns | 99.1% | 100% |
| Issues arising from recent genetics advances are studied | 98.2 | 100 |
| Instruct students in ways to make decisions | 95.5 | 100 |
| Outside resource personnel meet with classes | 36.6 | 95.5** |

**Significant at .01 level

Table 16
Percentage of Coverage of Topics Covered
by Criterion Group and Interview Group

| Topic | Criterion Group | Interview Group |
|---|---|---|
| Dom/Rec Traits | 100% | 100% |
| Sex-Linked Traits | 100 | 100 |
| Multiple Allele Systems | 100 | 100 |

**Summary and conclusions**

The purpose of this study was to determine the impact of the Genetics/ Bioethics workshops held in 1984-88 by comparing and contrasting two groups of participants who had attended workshops on Human Genetics and Bioethical Decision-Making held at Ball State University. The first group had attended the workshops during 1978, '79, '80, and '81 and comprised the reference group of the current study. The second group or the criterion group had attended the workshop during 1984, '85, '86, and '88. The results from this study, revealed a significant difference between the two groups in the grade levels taught. The criterion group taught more higher grade levels than did the reference group. An significant increase was also seen in the time spent on genetics in the classrooms of the criterion group. This increase in time may be accounted for by the fact that the teachers were teaching older students and more material could be covered.

The cross validation study revealed that respondees gave accurate responses to the research instrument. The results from the cross validation study were very similar to the results obtained in the written survey instruments given to the criterion group. Differences between the two groups of data could be accounted for by sampling error.

Dr. While's research compared the 1978-81 participants to a group of comparable teachers who had never attended the workshop. When data from both the criterion group and the reference group were compared to data obtained by Dr. While (1984) of teachers who were not participants of the workshop, the results reveal that more genetics is being taught in the classrooms of the criterion group. Also by looking at the topics within genetics covered by the criterion group, the results revealed that genetics instruction is centered more toward humans and related to the students needs.

Over a time span of ten years (1978-1988), it can be infered that the level of interest and commitment to project goals has been sustained in the workshop participants.

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# Appendix A

Appendix B

Personal Interview Survey Instrument

I. Did you complete and return the survey which you received from Dr. Hendrix and me?.....Yes No

II. When teaching genetics in the classroom do you cover dominant and recessive traits?.....Yes No

What examples do you use to demonstrate this topic?

Are they examples from a textbook?.....Yes No

Do you have your students do any type of laboratory work in this topic?.....Yes No

III. Do you cover the topic of sex-linked traits?.....Yes No

Is this topic found in the textbook you use?.....Yes No

Do you use other material for this topic?.....Yes No

If yes, what materials?

What type of examples do you use?

IV. Do you cover multiple allele systems in your class?.....Yes No

Do you give examples for this topic?.....Yes No

If yes, what?

Do you conduct any laboratory work with your students in this topic?.....Yes No

If yes, what kind?

V. Do you teach biology concepts in such a way that your students can relate them to human concerns and needs?.....Yes No

Comments:

VI. Do you ever have outside speakers come to your classroom to talk to your students?.....Yes No
Comments:

VII. Do you cover any controversal subjects in biology, especially in the field of genetics?.....Yes No
Comments:

Do you cover the topic in such a way as to help your students make decisions about the subject and their feelings?.....Yes No