



## ONLINE INQUIRY & INVESTIGATION

### Inquiry, Observation & Expression:

*Be Creative but Stay Genuine!*

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One of the benefits of attending national science conferences, staying current in the literature, and inviting guest lecturers is the sharing of ideas and strategies of the highest caliber. Ann Haley MacKenzie provided two of these through her article, *Planimal House* (MacKenzie, 2001) and subsequent presentation at the 2004 National Association of Biology Teachers (NABT) Annual Convention. The challenge for us was to take her inquiry-oriented project, a part of a science teaching methods class, and *test-drive* it for possible inclusion in our freshman level general biology college curriculum.

Our project was a six-week journey devoted to observing, researching, and sharing information about living organisms contained in the laboratory and/or students' residences. The general biology population, which included 20% international students, was comprised mainly of nursing majors, those interested in health related fields,

biology majors, and biology education majors. All of these academic fields demand good powers of observation and, by their very nature, require proficient writing skills. Our goal was to give the students "many ways to tell us what they knew." This is why we took a multi-genre approach.

The directive (Figure 1) was given to students who were, by registration, divided into four laboratory sections. Not only were students informed of the pending participation in an all campus showcase, they were advised that each laboratory section's submissions would be bound as a *published* collection of works. Additionally the bound publications would be given to area schools for library collections. Authentic assessment is a powerful impetus.

### Project Purpose

Our Department of Biological Sciences has a standard for writing to be used by all department members. It basically states that all students must learn to write in a clear and intelligent manner and that the faculty is required to grade all assignments for writing. One reason for instituting the project was to fulfill this goal.

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We chose to allow students to decide *how* they wanted to observe organism behaviors. They were drawing from previous experiences offered by class lecture on the nature of science, required reading of Olivia Judson's book, *Dr. Tatiana's Sex Advice To All Creation* (Judson, 2002), and notes taken during guest lecturer Michael Yerky's presentation on animal behaviors (Yerky, 2004). Dr. Yerky provided students with three different approaches that could be used in conducting behavioral observations. They could observe a single animal in its environment, an assembly of animals displaying group dynamics, or behavioral changes over time. Dr. Yerky focused on the questions that might arise as a result of observed behaviors and therefore provided a scaffolding approach for students to use in their subsequent investigations. Some options afforded the students included hamsters, fish, anoles as found in the laboratory setting, or family pet(s) for those living off campus. When all was said and done, we read about snakes, turtles, cats, ferrets, Holstein calves, dogs, guinea pigs, blue jays, Russian dwarf hamsters, goldfish, and other interesting "critters." About 15% of the student population (N=101) chose to observe animals outside of the classroom.

Another reason for choosing the project as a component of the curriculum was to afford opportunities for different learning styles. All students were required to do a mini-research component as part of the undertaking *but* the other two components were

## Figure 1.

Assignment as presented to Biology 101 students, spring 2005.

### Inquiring: Watch, Write, Publish

*Be creative but stay genuine!*

You are about to embark on a six-week journey. This journey will provide you a forum for asking questions, for wonderment, and for curiosity. The tasks that you will engage in during this journey are designed to reinforce the nature of science, allow exposure to biodiversity and organism behaviors while providing a platform for creativity.

In order to truly experience the nature of science, one must make observations, ask questions based on the observations, research what is known, reflect on this information, and convey findings.

Each of us takes in information from our environment and constructs individual meaning from such. As we construct our knowledge, we may talk about it with others or we may write about the newly acquired knowledge. This learning experience will allow each of you to be innovative in your writing as well as provide for creative thinking and expression.

You will take part in what is known as multi-genre writing. The laboratory class(es) will "create" a magazine. It may contain:

- Full length, researched articles
- Poetry
- Interviews
- Advertisements
- Drawings (Free-form or computer generated)
- Editorials
- Photographs
- Other
- Evolutionary history accounts
- Figures (graphs)
- Brief synopses
- Narratives
- Advice Columns
- Puzzles
- Cartoons

From the list you can understand that the term multi-genre refers to type (Haley MacKenzie, 2001). A magazine provides us with many types of information. Our magazine(s), *four labs*, will reflect depth of topic, vitality in expression, and a product that is rich in information. It (they) will become a part of the All Campus Showcase.

Each student will select and develop genre pieces for the documents (a minimum of three per person). One of the three must be a researched piece complete with citations. At least three citations are expected. APA style format is requested. All work must be word-processed, accompanied by a diskette, CD, or Zip disk and done on a PC using MS Word®.

The laboratory classroom has a variety of animals residing in tanks. Each student will choose an animal in the laboratory or, if preferred, residence. Over the course of six weeks, he/she will observe the behavior of the organism(s) for a minimum of 40 minutes per week outside of required class time (Haley MacKenzie, 2004). The 40 minutes can be broken into smaller chunks if necessary. The magazine inclusions will capture your impressions, observations, investigations, and reactions.

There will be deadlines for work (in stages). There will be a rubric designed for assessment and evaluation of pieces. There will be periodic team meetings for students observing the same organisms as well as periodic class discussions. We want to bring our organisms to LIFE for our readers. We want readers to explore biodiversity as well as share in the NATURE OF SCIENCE!

Haley MacKenzie, Ann. (Nov 2004). Presentation: Inquiry within writing: The multi-genre science experience. National Association of Biology Teachers. Chicago, IL.

MacKenzie, A. (2001). Planimal house an inquiry-oriented project in which biology students study live organisms. *The Science Teacher*, pp. 40-41.

**Table 1. Rubric used for researched animal information.**

CRITERIA	EXEMPLARY (90-100)	SOLID AND WORKABLE (80-89)	COULD USE SOME FINE TUNING (70-79)	NEEDS SOME SERIOUS WORK (60-69)
Purpose	Writing purpose is very apparent to the reader.	Purpose is clear but writer wanders sometimes.	Purpose not consistent throughout the paper.	Purpose is generally unclear.
Content	There is a balanced presentation of relevant and valid information that clearly supports the purpose and shows a thoughtful, in-depth analysis of the topic. The reader gains important insights.	Information provides reasonable evidence of a basic analysis of subject. Reader gains some insights.	Analysis is basic or rather general and reader gains few insights.	Analysis is vague or not evident and the reader may become confused or misinformed.
Organization	Ideas are logically arranged. They flow smoothly from one to another and are clearly linked.	Ideas are logically arranged. Ideas are usually clearly linked and for the most part the reader can follow the line of reasoning.	Writing is generally arranged logically. Occasionally the ideas don't make sense together. Reader is fairly clear about what the writer intends.	Writing is not logically arranged. Ideas fail to make sense together. Reader loses interest.
Feel	Writing is compelling. The reader is hooked and interest is sustained throughout.	Writing is generally engaging, but contains some dry spots. Reader's attention is generally maintained.	Writing is dull and not engaging. May be some interesting parts but difficult for reader to maintain interest.	Writing has very little <i>personality</i> . Reader quickly loses interest and stops reading.
Tone	Consistently professional in tone. Appropriate for academic intent.	Tone is generally professional. Most of the time it is appropriate for academic work.	Tone is not consistently professional. Not appropriate for an academic article.	Unprofessional tone. Not appropriate for academic article.
Sentence Structure	Well-phrased sentences. They vary in length and structure. Sentences flow smoothly one to another.	Sentences are well phrased. There is some variety in length and structure. Sentences generally flow smoothly.	Some awkward sentence structure which distracts the reader.	Errors in sentence structure are frequent and a major distraction to the reader.
Word Choice	Word choice is consistently precise <i>and</i> accurate.	Word choice is generally good. Writer goes beyond the common word to find one more effective.	Word choice is just adequate. Range of words is limited. Some words are used inappropriately.	Many words used inappropriately, confusing to the reader.
Grammar, Spelling, Writing Mechanics (punctuation, italics, capitalization, etc.)	Writing is free or almost free of errors.	Occasional errors but they do not present a major distraction or obscure meaning.	Writing has many errors. Reader is distracted by them.	So many errors that meaning is obscured. Reader confused and stops reading.
Length	Contains number of pages specified in assignment.			Fewer pages than assigned.
Use of References	Compelling material from professionally legitimate sources. Attributions are clear and fairly represented.	Professionally legitimate sources are generally present and the attributions are fairly clear.	Attributions occasionally given, many statements seem unsubstantiated. Reader is confused about source of information and ideas.	References seldom cited to support statements made.
Quality of References	Reader is confident that information and ideas can be trusted.	Some references are questionable. Reader is uncertain of reliability of some references.	Reader doubts accuracy of most of references.	Virtually no sources and reader has serious doubts about material cited and stops reading.
Us of APA style	APA used accurately.	Some minor errors.	Frequent errors.	Doesn't use APA.

Author unknown. Retrieved February 2005. Adapted from <http://www.ksu.edu/apr/Learning/ResearchRubric.pdf>.

by individual choice. It was quite exciting to read poems, interviews, advertisements, narratives, advice columns, puzzles, and cartoons, as well as enjoy the artwork that was rendered. The four laboratory sections definitely provided multi-genre submissions as set forth by this project.

## Student Work

Over the course of the six weeks for this project, the students had three different assignments due, one assignment every two weeks. The first assignment was the same for each student; they were to submit a short research paper based on a previously adapted rubric (Table 1), containing at least three references on their observed animal of choice.

With the next two submissions, the students had the freedom to select their genres of choice. Many of their selections included answers to their questions raised from initial observations: capturing pictures of specific behaviors or researching further for behavior explanations to model Olivia Judson's technique (Judson, 2002) in conveying information through the use of anthropomorphism (Figures 2 and 3). We recognize that giving human qualities to animals is not a component of science per se. However, with this assignment, we wanted students to be creative in their levels of expression. Both McKenzie (MacKenzie, 2001) and Judson (Judson, 2002) have taken this approach with their writings. Dr. MacKenzie is a scientist, educator, and journal editor; Dr. Judson is a scientist in the field of evolutionary biology and behavior and is well published (Judson, 1993; Judson, 1994; Judson & Normark, 2000).

The students favoring the multiple intelligence category referred to as Verbal/Linguistic took advantage of the opportunity to submit journals, advice columns, poetry, anecdotal records of trips to the veterinarian, what their pet meant to them, and "interviews" with their selected animal. Figures 2 and 3 give just a sampling of some of the student work in this area.

### Figure 2.

Anthropomorphic statements from an Australian cattle dog, composed by Patrick Will.

#### Things My Cattle Dog Might Say, If Only He Could Talk

- Why doesn't my menu ever change?
- Something tells me we're not in Queensland anymore!
- Your ankles are just going to have to do.
- Hey buddy, when are you going to get your own bed?
- Why does the cat get to sit on your lap?
- Grooow! Get a look at that German Shepard!
- A little to the left, no, now a little bit to the right . . .
- *You* chase the frisbee!
- Boy, you sure are bossy!
- Hey, I am a herder, not a Poodle.
- Get back in your herd or I'll . . .
- How much is a one-way ticket to Sydney?
- Tired? NEVER!!!

### Figure 3.

Advice column (abbreviated) on hamster reproduction and pregnancy by Colleen Root.

#### Letters on Hamster Reproduction & Pregnancy to Dr. Root

**Dear Dr. Root: My wife and I are expecting our first litter of pups; we are extremely excited. I would like to know if you can tell me what to expect of my wife when she goes into labor?**

*~Anticipating birth in Russia*

Dear Anticipating: First I would like to congratulate you and tell you that you are in for a lifetime of happiness! Now to the birthing process, when your wife goes into labor she will be overly active and start breathing faster and more rapidly than usual. She will also switch activities often and be restless. You may see her cleaning the genital area which means it is time! She will then proceed to deliver the pups by sitting up and crouching. When the pups come out she will lick them clean so be sure to give her space. Most of all enjoy your new pups and the miracle of birth!

**Dear Dr. Root: Five days ago I gave birth to 6 beautiful pups and I am pregnant again! Dr. Root, I just don't know how I am going to be able to handle giving birth again in a few weeks while nursing and taking care of my new pups, I am just so tired right now. Is there any advice you can give me or is there anything I can do to help postpone my next labor?**

*~Exhausted in Beijing*

Dear Exhausted: Lucky for you a mother's body responds to stress and since it is very common for mother hamsters to get pregnant consecutively, your body will make up for it. There are 2 methods that can happen: one is called delayed implantation where the embryos will not attach to the wall of the uterus for a day or two after they normally would. The other method is called postimplantation embryonic diapause. With this method the embryos attach to the mother's uterus but they do not begin growing until the conditions of the mother have improved. Don't worry; you will not give birth to those pups until your body feels you are ready!

These writings were based on their personal observations, research, and/or both.

The students preferring the kinesthetic learning style took advantage of the opportunities to submit artwork (Figure 4). Submissions included drawings done in ink, pencil, colored pencils, and computer graphics.

With the technology available today, students used their digital cameras to “shoot” their animal (Figure 5). Some students were very creative with the editing of these pictures, thanks to computer programs.

Student observations generated questions for investigations, such as: Why do cats knead? What is the purpose of an anole’s dewlap? Why do some fish school? Why do some fish feed anemones? From the generated questions above, we received student answers in the forms of reports, poetry, photographs, and drawings. As instructors, little did we know what the true meaning of multi-genre would be for this project.

**Figure 4.**

Student rendition of an anole. Pencil and ink drawing done by Bio 101 student Kenny Nelson.



**Figure 5.**

“There is no need for a piece of sculpture in a home that has a cat. . . .” Wesley Bates. Student’s sleeping sculpture commands attention. Picture by Alissa Glading.



At this point, we realize that it would have been valuable to ask for student input into how they would be assessed in answering their generated questions. For example, when looking at a submitted photograph of a fish, were we to assess the quality of the image or the fish behavior shown in the photo, or both? If both, should the components have been equally weighted?

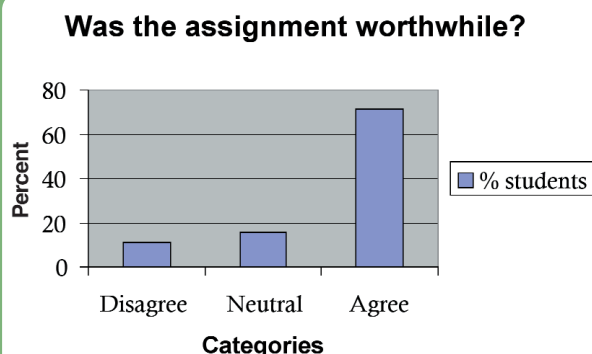
## Results

At the end of the Animal Project, students were asked to address three questions about this project. The first question asked the students if they felt this project was worthwhile. Seventy-one percent of the students (N = 101) thought that this project was worthwhile (Figure 6).

The students were also asked if the experience gener-

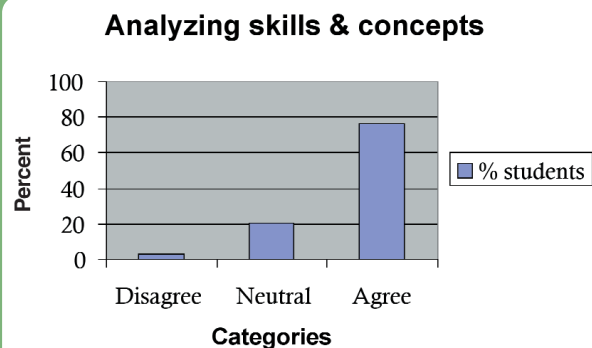
**Figure 6.**

The students (n=101) were surveyed to determine if this Animal Project was a worthwhile endeavor. Over 71% of the students agreed that it was a worthwhile project.



**Figure 7.**

The students (n=101) were asked to response to this statement: *The experience generated by the Animal Project provided an increase in my abilities to make observations and gain knowledge in biodiversity.* Seventy-two percent of the students agreed with this statement.



ated by the Animal Project provided an increase in their abilities to make observations and gain knowledge in biodiversity. Over 72% of the students agreed with this statement.

Finally, the students responded to this statement: *The Animal Project allowed me to be more creative than I normally experience in an academic course.* Results indicated students (76.47%) felt this project allowed them to be more creative (Figure 8).

In addition to these questions the students were asked to write their comments about the project. The students were not the least bit inhibited when expressing their feelings about their assignments. The one area they all seemed to agree on was they enjoyed being able to select the genre for their assignments. We had over 200 statements/comments from the students. Figure 9 gives just a small sampling of these comments.

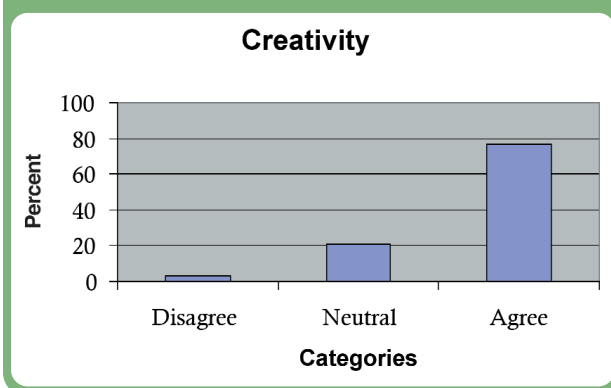
## Instructors' Evaluation

Table 1 allows for assessment perusal and Figures 6-9 give insight into student appraisal of the assignment with which they were challenged. As previously stated, this project was a trial run to identify the components that would need to be developed for incorporation into the Biology 101 curriculum.

From our trial run we now have a clearer picture for establishing goals and objectives, assigning weight value in grading, instituting faculty/student generated rubrics for the different genres, and seeking assistance from faculty members from other disciplines (Fine Arts, English, Technology). We have already generated a pre- and post-survey that will allow for measurement in student learning,

**Figure 8.**

The students (n=101) were asked to respond to this statement: *The Animal Project allowed me to be more creative than I normally experience in an academic course.* The students (76.47%) felt this project allowed them to be more creative.



**Figure 9.**

The students were asked to write what they liked and did not like about the multi-genre writing Animal Project. Below is just a sampling of the 100+ responses.

### Sampling of Student Comments:

- It looks very pretty (magazine). Everything is organized and well put together.
- It looks like something to be proud of.
- I felt that this was interesting but the amount of work expected was unnecessary when there was so much other work to be done. Especially for a Bio 101 class.
- Students are very creative when given the chance.
- The students did an amazing job. I enjoyed selecting the type of project I could work on.
- Great project, I would not change much about it.
- This was an easy grade and allowed us to be creative. Many students did an amazing job.
- This experience allowed us to express our creative side and improve our writing skills. Animals are fun and everyone interested in Biology loves animals—well most of them.

innovative in their writings and provided for creative thinking and expression. As a result, each laboratory section produced a magazine of its work (Figure 10). Authentic assessment was very evident during the Spring All Campus Showcase for student work. Many positive comments were made as faculty and students perused the magazines on display. Some of the students who were featured in the magazines brought their roommates, significant others, or sports teammates to the viewing.

Additionally some changes that will be made include staggering the collection dates for elements within the project and cutting down the weekly time for students to make their observations. We are presently developing rubrics for multiple genres. An example is shown in Table 2.

## Conclusions

As educators it is important to address the diverse learning styles that exist within the students found in our courses and to try new ideas. Different people have different ways to tell you what they know. We feel it is vital to incorporate lesson plans/activities that address students who have visual, verbal, tactile, kinesthetic, and/or auditory learning styles. Therefore it is essential that all of the students have a chance to be *heard* through the lessons offered them as well as providing them with authentic assessment on their assignments. For example, it was easier for our Japanese international students to express themselves through photography and art work than written reports.

The authors of this paper have a history of instilling “Out of the Box” opportunities through inquiry-based experiments/activities for their courses. For example, the learning experience discussed in this paper allowed students to be

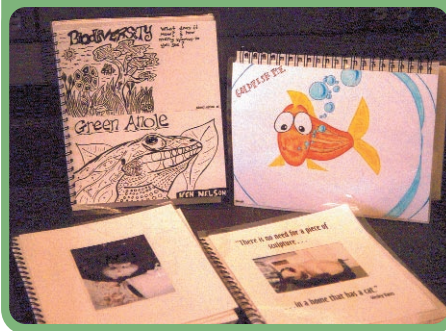
**Table 2. Drawing rubric that allows for student input.**

CRITERIA	EXEMPLARY 4 pts	ACCOMPLISHED 3 pts	ACCEPTABLE 2 pts	NEEDS CONSIDERABLE WORK 1 pt
Reflection of Information Student Wants To Convey	Clearly represents an artistic rendition of the student's evidence of learning.	Represents an artistic rendition of the student's evidence of learning.	Somewhat represents an artistic rendition of the student's evidence of learning.	Unable to discern what learning may have occurred.
Neatness	Exhibits a high degree of craftsmanship, with no smudges, folds, or evidence of erasure.	Artwork is neat. There are no smudges or folding but erasures are visible.	Artwork is generally neat. Some smudging evident, no folds and erasures are visible.	Little effort shown in maintaining neatness. Smudges evident. Folding and erasures are very obvious.
Creativity	Expression was created with effective use of line, shadow, and original thought.	Some evidence of original thought demonstrated. Uses line and shadow competently.	Limited evidence of original thought. Effective line use but little to no shadowing evident.	Little effort made toward creative expression. No evidence of original thought.
<i>(Other Criteria Students Develop)</i>				

At the end of this inquiry-based activity, the students (N = 101) provided instructors with both a quantitative as well as a qualitative assessment of their experience. Their feedback will be truly invaluable as we design the next iteration of *Inquiry, Observation, and Expression*. We feel that the testing of this project was a positive step in considering the nature of science. We, as instructors, have made observations of our students' observations, formulated questions, experimented with ideas, reached some conclusions, and are continuing to develop a more polished version of the Inquiry, Observation and Expression multi-genre project.

**Figure 10.**

Each laboratory section (4) created its own "magazine" based on its multi-genre assignments. Each magazine had over 100 pages of student work.



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