Using Elementary Interactive Science Journals to Encourage Reflection, Learning and Positive Attitudes toward Science

Abstract

Interpreting, analyzing, and interacting with science is a critical aspect in the classroom. Without incorporating these elements, true understanding of science is a difficult task. As national mandates and standardized testing become more prolific, educators are reaching for efficient tools. The purpose of this study was to determine the effectiveness of an interactive science journal as a successful tool in the classroom. Over a 12 week period, a class of 22 science students used the interactive science journals an average of four times per week. This paper discusses the advantages and disadvantages of using the science journals in the classroom.

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Introduction

When children are forced to think about science and write about science, they are engaging in intelligent learning. Journals are not a new concept in the elementary classroom. Elementary Language Arts educators have use student journals for many years. Science educators are slowly realizing the potential benefits to the use in the science classroom as well (Shepardson & Britsch, 2000).

The use of journals in elementary science classrooms as a tool for engaging students has been widely discussed. The increased amount of research in the past few years shows there is growing strength and support for the use of science journals. When students are able to explain what they think and what they have seen, they are forced to use clarity while trying to organize their thoughts. Working through their explanation also forces them to explain their ideas in such a manner that others can comprehend their ideas (Azimioara, Bletterman, & Romero, n.d.). This type of writing tends to be insightful in nature, allowing the student to reflect on the content as well as their own understanding. John Dewey's work has had a great influence on education from the turn of the twentieth century through the 1930s. Dewey (1916) wrote, "Thinking is the method of intelligent learning" (p.153). Interactive journals provide the student with the opportunity to read, write, describe and think about the science they are learning. Writing and describing is not limited to any one style, but a variety of methods is encouraged. Such methods can include, but are not limited to: thoughts, stories, poetry, drawing, and graphic organizers. One such organizer is concept mapping which has been shown to enhance students' learning in the science arena (Kinchin, 2000).

Review of Literature

The use of interactive science journals is important for many reasons. By using the journals, students are provided with the opportunity to model the data collection forms that scientists use. Another reason for keeping the interactive journals is to provide a means of reference and resource for the student throughout the year. The journals are also a great communication tool between the teacher and the parent/guardian. A fourth reason is journals provide a unique means of assessment. The fact that writing improves learning is still another reason that interactive journals in the science classroom make good sense (Gray, 1988). The last compelling reason to use interactive journals in the science classroom is to give the teacher another tool to make the student more successful. With increased understanding, grades should rise. One of the most vital functions of scientists in any discipline is recording information, data and figures. Students begin to model, somewhat basic, the collection and interpretation of the data just as real scientist do. Data from their own experiment, or a teacher demonstrated, should be recorded in the journal. This allows for the analyzing and interpretation of the data in the journal in any given time frame.

Interactive journals maintained on a daily basis can be used to assess the growth of individual students (Young, 2003). Some students are not great test-takers. However, they are learning and processing the information presented. Close examination of their journal may present a clearer picture of their progress. The journals also show progress on a continuum as opposed to bits and pieces. Students are accustomed to seeing their short-term progress. As they begin to see long-term progress, opposed to the quiz they failed, they gain confidence in their own abilities and their attitudes will reveal positive boost.

Successfully learning to writing up a lab is an important achievement; however, learning to express lessons learned in that lab as it relates to the student is equally important. Hyers (2001) states the more the students write about science, the more opportunity they have to relate new concepts to previous understanding and current knowledge. When students make connections to their learning, it becomes personal and therefore long-term learning is likely. Holt (2003 ¶ 4) fittingly stated, "The trick to good learning is to use some method of teaching that helps students retain information for the long term, long after they have left your class."

Perhaps the most compelling reason to support the use of interactive journals is because what science educators have been doing is not working effectively. In the *Nation at Risk*, published nearly two decades ago during Ronald Reagan's turn at running the nation, showed that student performance was falling (Frase, 2000). It was followed by an enthusiastic call to arms and it was upheld by the successive "education presidents" in the White House. In order for American children to possess the skills to be "number one", we saw the birth of "Goals 2000" (Gross, 1999, p. 25). In line with the goals, the current education model places a high value on developing skills as the purpose of schools. It is clear that the Texas Education Agency (TEA), itself, is vested in the development of skills. The backbone of TEA's education policy is based on the Texas Essential Knowledge and Skills (TEKS), with a heavy influence on "skills".

In order to help students acquire these skills, President George W. Bush's "No Child Left Behind" (NCLB) education law comes to the rescue in January 8, 2002. The

NCLB law asks America's schools to, among other criteria, describe their success in terms of what each student accomplishes. If it is our goal to arm children with skills, conceivably the current skill-based assessments should help us achieve that goal.

However, there is no conclusive evidence that our education system is successfully propelling our students to the “number one” spot. A snapshot of the Nation’s report card showing student’s mounting achievements (or there lack of) is provided with the help of the National Assessment of Educational Progress (NAEP). NAEP has been conducting sample assessment across the United States since 1969 in the areas of math, reading, science, writing, and other areas. In 2000, 46 states participated in the NAEP 2000 mathematics, reading and science assessment. Looking at the numbers provide by The National Center for Education Statistics, the news appears positive in math but only stable in reading and science. Math scores have risen for fourth and eighth graders despite a recent decline among high school seniors. Reading scores for the fourth graders showed a relatively stable pattern in students' average scores during the last decade. Science scores remained stable since 1996 with the fourth and eighth graders, while scores for high school seniors have declined (State, 2000). With two out of the three subject areas experiencing declining averages for seniors, it might be concluded that the longer students are in school, the rate of improvement decreases. The current school program seems to be a detriment to high school students. In addition, it must be noted that both math and reading are essential elements to the successful science student.

As educators, we must ask ourselves to identify the purpose of education. Philosopher Matthew Lipman (cited in Reed, 2000) comes close to the purpose of education when he states, "An educated person is one who can think for herself or himself, who is self-reflective and self-corrective, and who values the act of thinking critically." In general, our current purpose has an unstated skills-based philosophy behind it. However, standardized test scores are not reflecting a high and climbing success rate. A shift in philosophy could help promote better educated students. If we concern ourselves with teaching students to be critical thinkers, then we really are in the business of true education.

Under the illusion of training the mind, teachers often use practices such as "drill and kill'' to gain quick results. Ironically, these drills hardly touch the mind at all. Skills may be obtained, but at what cost? Students become worn-down, bored and often disinterested in school. Teachers wonder why students read with so little expression or perform math with little intelligent consideration of the problem itself (Archambault, 1974). School becomes a mindless activity where students sit at desk among thirty or so others, being talked at with boring lectures, doing boring exercises, endless tests, and boring worksheets. This procedure is maintained year, after year, after year (Egan, 1997). This type of teaching is ineffective at teaching critical thinking skills. The use of journals afford the educator the opportunity to "expand minds" as apposed to "training minds".

The positive aspects and experiences with using journals greatly outnumber any unenthusiastic response by educators. However, 5th grade teacher, Larry Swartz, abandoned using journals because he felt their used did not offer the same opportunities for fruitful interactions and discussions. He also disliked the time constraints and the simple summaries his student's produced. (Wells, 1994) This abandonment may have been due to Mr. Swartz's particular learning/teacher preference and not due the ineffectiveness of the journals themselves. If anything, the journals would assist the educator in connecting to the tactile and visual learners, while at the same time allowing the auditory learner to take lecture notes. Any tool the educator uses must be examined and altered to fit the schedule. Interactive journals do not have to be used on a daily basis if the time is not permitted. In order to address the simple summaries Mr. Swartz received, he must look at his own interactions with the student and their journals. Once student master the structure of the journal, writing encouragement can be used to foster in-depth responses.

Methods

Participants

The sample for this study was selected from a total population of 96 fifth grade students in a middle-class public elementary school in Arlington, TX. The population was 91% Caucasian, 6% Hispanic, and 3% African American. Twenty-two students were selected to participate, fifteen females and seven boys, from a mixed-ability group of non-self-contained science students.

Instrument

The Test of Science Related Attitudes (TOSRA) was the instrument used as both a pre and post test to evaluate the attitudes of the students. The instrument was "based on the original 70-item Test of Science Related Attitudes (TOSRA) developed by Fraser (1981), the TOSRA2 is comprised of two 35-statement questionnaires pretest/posttest" (Fraser 1981). It was designed to be used with either children or adults to evaluate changed in attitudes in the following five scales: 1) social implications of science, 2) normality of scientists, 3) attitude to scientific inquiry, 4) adoption of scientific attitudes, and 5) enjoyment of science lessons, leisure interest in science, and career interest in science. Participants took the pretest survey at the beginning of the study and the posttest survey was finished at the completion of the study.

Experiment Design

A medium size composition notebook was used as the interactive journals. Papers, such as instructions, notes, labs, etc. were periodically glued into the notebook. However, students did not add or rip out any other pages. All students organized their journals in the way; the right side of the journal is for input and the left is for output. Input includes, lecture notes, handouts, and labs. The left output side included items such as drawings, reflections, lab write-ups, etc. (see Figure 1). After completing the assignment or lab, students interpreted their data to complete the left side of their journal. Students were instructed to always date and number their pages consecutively throughout their journal. Instructional information on using the journals was glued to the front inside cover as a reference tool for the student (see Figure 1). In addition, the scoring rubric was also glued to the back of the journal to inform both the student and the parents/guardian about scoring (see Figure 2).

The study with the interactive journals lasted 12 weeks, with usage averaging 4 times per week with current unaltered curriculum. Grading was done randomly though the study. Grades were based on the rubric and student's independent work. Since journals were not taken home, work was completed without assistance of parents or guardians, making grades reflective of students alone.

Figure 1- Journal Instructions

Science Interactive Journal

Left Side

The left journal side demonstrates your understand of the information from the right side page. You work with the input, and INTERACT with the information in creative, unique and individual ways. The left side helps focus your attention and guides your learning of the science content and concepts.

What goes on the left side?

Output goes on the left side!

- Every left side page gets used!
- Always use color and organize information
- Color and organization helps the brain learn!

What could go on the left side?

- Brainstorming
- Concept maps
- Pictures
- Diagrams
- Flow charts
- Poems
- Worksheets
- Mind maps
- Venn diagrams
- Drawings/sketches
- Writing prompts
- Self reflections
- Lab results
- Songs

Right Side

Science interactive journals are used to help you learn and remember important scientific concepts. Why do they work? This journal style uses both right and left-brain hemispheres to help you sort, categorize, remember, and creatively interact with the new knowledge you are gaining.

What goes on the right side?

Input goes on the right side!

- Always write the data on each page and label the assignment!

Guidelines:

- The right side of the journal has only odd numbered pages.
- The right side page is for writing down information that you are given in class (input).
- When the teacher gives lab instructions, oral information, and /or content-specific information, you take notes on the right side.
- When you take book notes or video notes, they go on the right side.
- Lab activities go on the right side.
- Any other type of INPUT you get in class goes on the right side.

Student Objective

After sufficient practice, students who keep interactive journals should be able to:

- increase their understanding of science concepts based
- use writing as a process of discovery
- improve their ability to organize ideas and information
- recognize the connections between thinking and writing
- write more freely, more comfortably, and more often

Adapted from *Science Scope,* NSTA publication, January 2003

Figure 2- Journal Grading Rubric

Science Interactive Journal Grading Rubric	
6	• Journal contents are complete, dated, and labeled • Pages are numbered (odd on the right; even on the left) • Right/left side pages topics are correct and contents are well organized • Notes go beyond the basic requirements • Uses of color and effective diagrams/sketches • Shows impressive, in-depth, self-reflection
5	• Journal contents are complete, dated, and labeled • Pages are numbered (odd on the right; even on the left) • Right/left side pages topics are correct and contents are organized • Includes most of the traits of a "6", but lack excellence in all areas • Most area meet requirements but do not go beyond • Shows in-depth, self-reflection
4	• Journal contents are complete (at least 90%), dated, and labeled • Pages are numbered (odd on the right; even on the left) • Right/left side pages topics are correct and contents are organized • Uses color and some diagrams • Information shows basic understanding of content topics • Some areas meet requirements, but do not go beyond • Shows some real self-reflection
3	• Journal contents are complete (at least 80%), dated, and labeled • Pages are numbered (odd on the right; even on the left) • Right/left side pages topics are somewhat organized • Uses minimal color and few diagrams • Information shows limited understanding of content topics • Few areas meet all requirements • Shows some real self-reflection
2	• Journal contents are incomplete • Some attempt at dating and labeling of entries is made • Right/left side is inconsistent and contents are unorganized • Uses minimal color and few diagrams • Information and concepts show only a superficial understanding of the subject matter and/or show serious inaccuracies • Journals is not neatly written • Shows little real self-reflection
1	Journal turned in, but too incomplete to score
0	No journal turned in for grading!!

Adapted from *Science Scope,* NSTA publication, January 2003

Results and Analyses

The *t* test was used order to test the difference between means from the pretest and the posttest. After calculating the survey results, and referring to the Distribution Table of *t,* no significant difference was found for the scales (Gay & Airasian, 2003). This does not confirm that the journals did not making learning better, but that the kids do not perceive science/scientists differently because of their use. A further study using a more specific instrument would benefit this research.

Personal interviews with the students revealed that the journals made learning more fun and meaningful. The following is dialogue with “Student A” and”Student B”:

Interviewer: How do you feel about using the interactive journals?

Student A: Good, I can learn from them.

Interviewer: What do you mean?

Student A: It is fun and it teaches me stuff.

Interviewer: Do you enjoy science lessons using the journals?

Student A: Yea, I get more from doing it.

Interviewer: Would you like to use the journals more often?

Student A: Yea, that would be good

Interviewer: What would make the journals more useful to you?

Student A: Doing more labs in the journals.

Interviewer: How do you feel about using the interactive journals?

Student B: They're cool

Interviewer: Why?

Student B: It is fun and it helps me.

Interviewer: Helps you what?

Student B: Understand science

Interviewer: Understand how?

Student B: It helps me learn by making it stick in my brain.

Interviewer: "Sticking in your brain" does not happen with the other ways of learning that we use?

Student B: No way.

In addition to the interviews, the output from the journals themselves also shows the diverse methods students choose to make connections with their learning (see Figures 3-8 in Appendix). Poetry, short stories, comics, lyrics, diagrams, and graphic are representative of the samples studied. The students were able to decide on their own method for learning and understanding the content of the lessons.

Conclusion

Interactive journals are flexible tools that gives the students the opportunity to think, reason, show creativity and even practice the much need skills to be successful in science. The journals cultivate high-order think skills such as problem-solving and critical analysis. When allowed to reflect on one's learning the whole process becomes more meaningful. Students, parents, and teachers can see the progression of the learning process from the beginning of the year to the end. The recognition of cognitive growth is not only more meaningful than a worksheet or report card grade, it is also a realistic assessment tool.

Numbers cannot, and never will, tell the whole story. The excitement on the face of a student revels much more than statistic, or standardized testing, ever hopes to present. "Are we going to use the journals today?" was daily question asked by at least one student. If the answer was "yes," the room was overwhelmingly filled with joy. Now that is positive attitude.

If educators are happy with the results they are getting, why should they change how they are teaching? Some educators may be happy, but the answer is that things can always be better. Educators can be so much more than dispensers of knowledge. A more effective role is collaborator and facilitator. If we can get students interested in their own education, our battle is won. Get them involved in the information and let them process it, write about it, think about it, and digest it. At the current rate of "moving through the book," there is little time to read for understanding, much less to digest the material. Any resource that helps teachers facilitate the learning process must be taken seriously. Interactive science journals are one such resource. They do not require a change in curriculum or present a big learning curve; however they do require a change in attitude. Teachers must be willing to allow students to gain more control over their own learning and understanding. This small amount of control presented to the learner is perhaps the most important gift that teachers can give to their students.

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APPENDIX

Figure 3- Journal Output-Student A

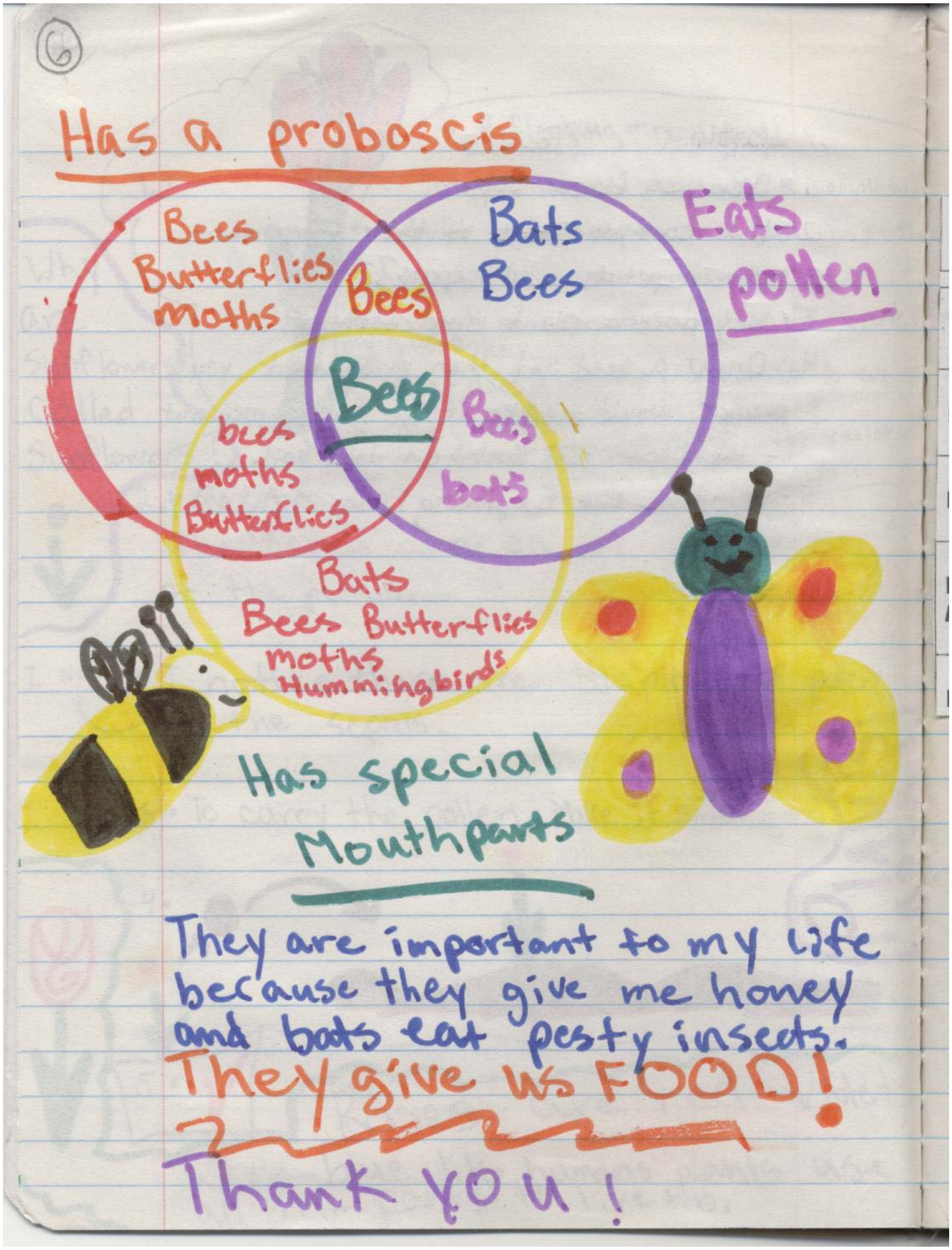


Figure 4- Journal Output-Student B

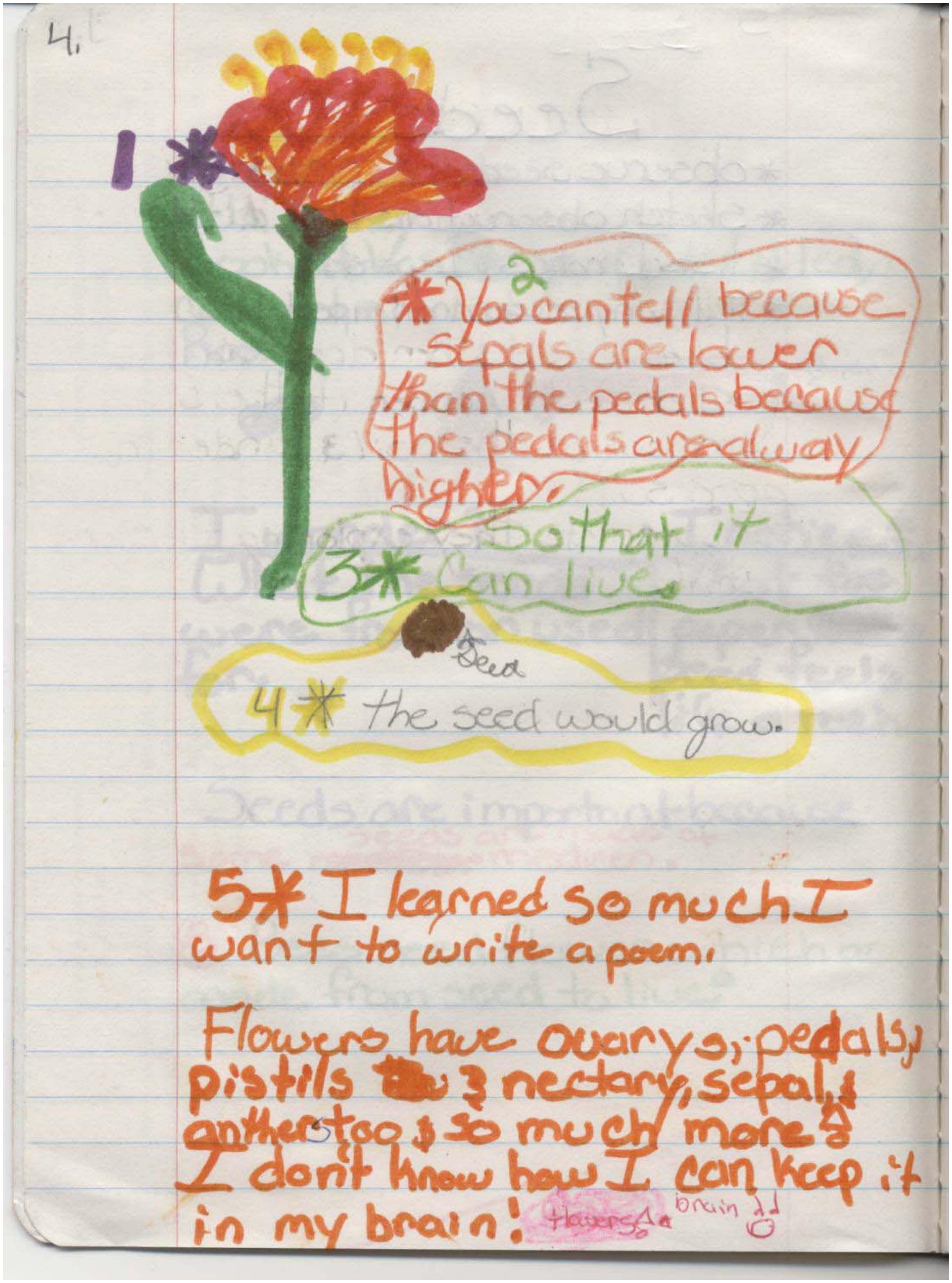


Figure 5- Journal Output-Student C

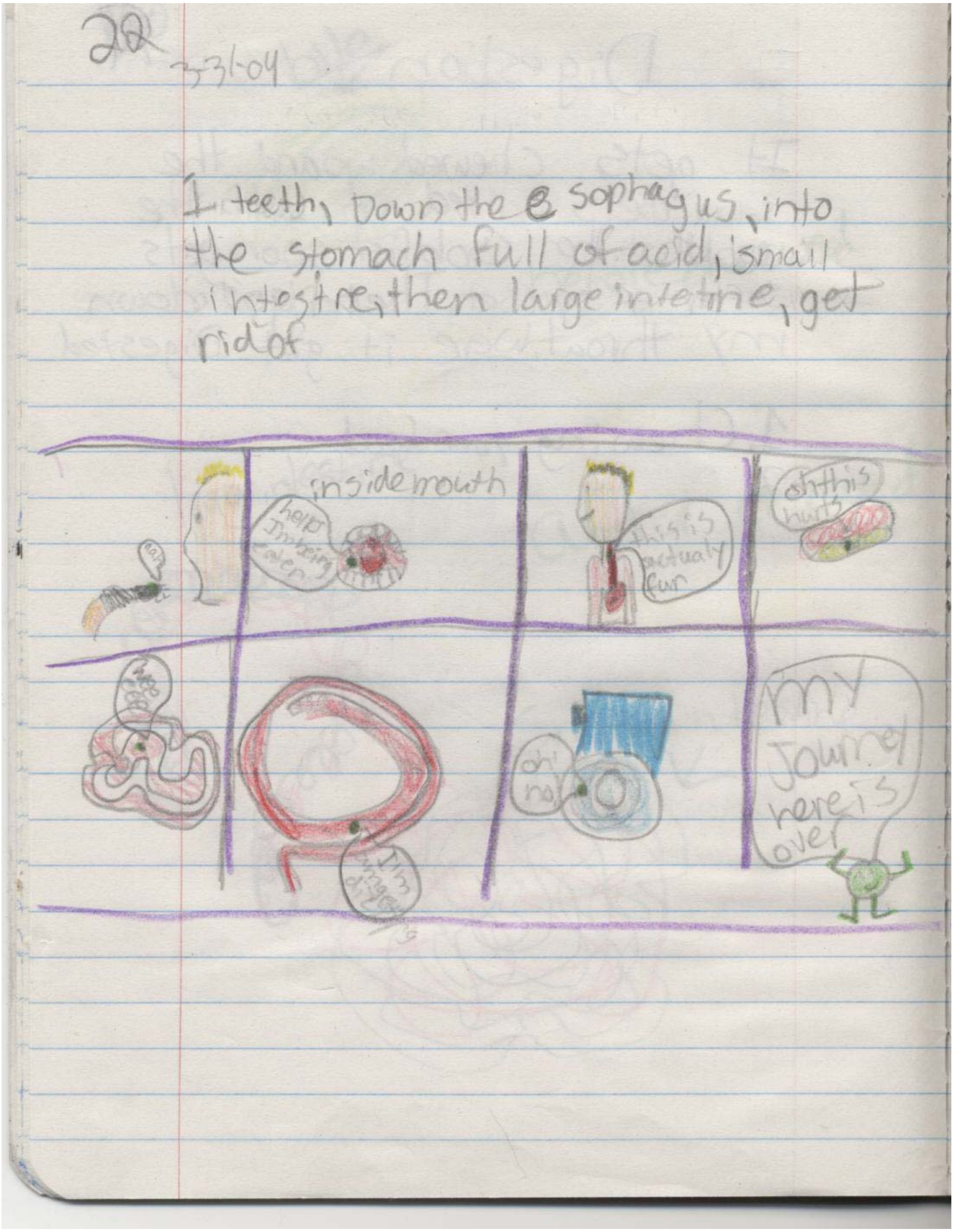
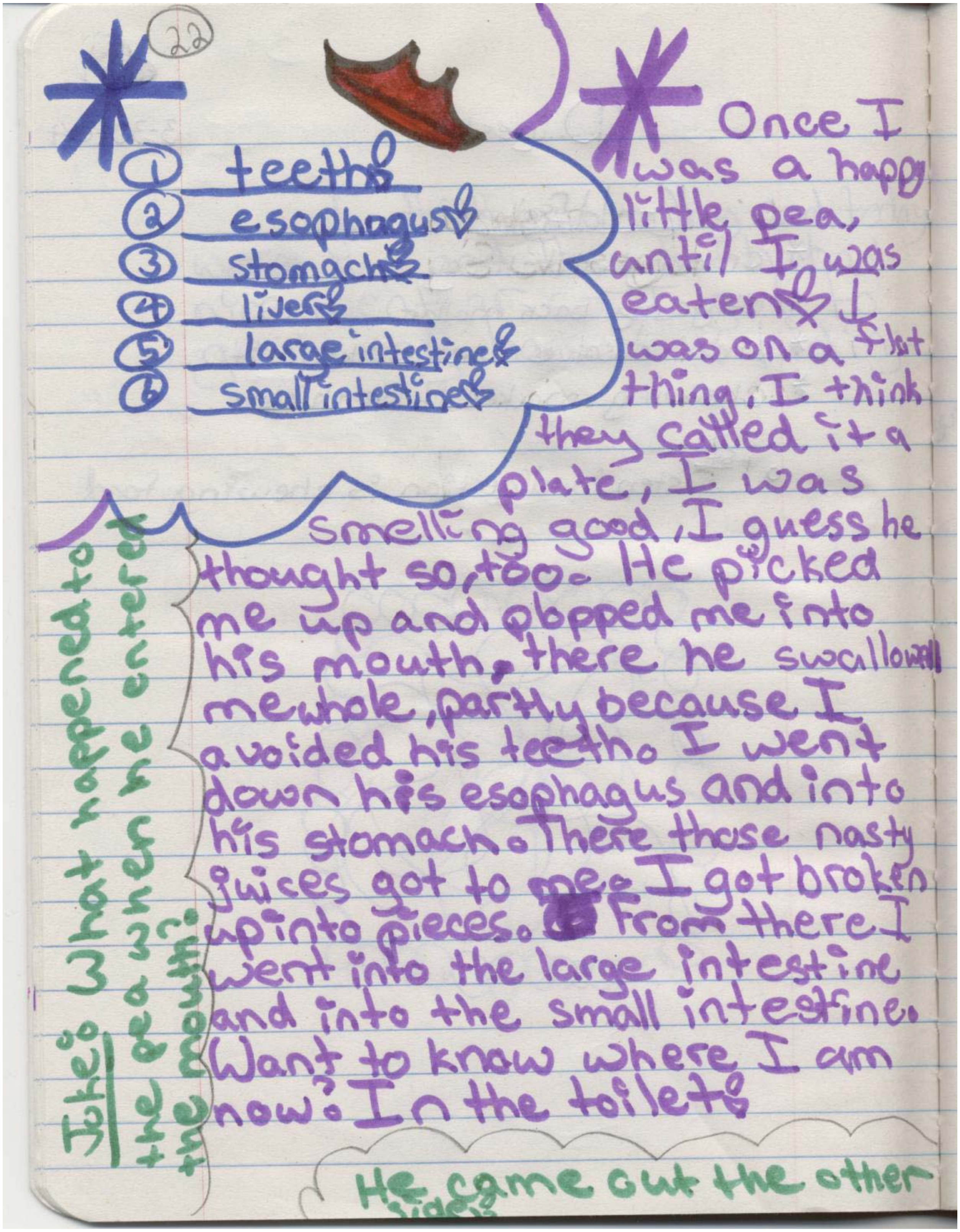


Figure 6- Journal Output-Student D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1. teeth
2. esophagus
3. stomach
4. liver
5. large intestine
6. small intestine

Once I was a happy little pea, until I was eaten! I was on a flat thing. I think they called it a plate, I was smelling good, I guess he thought so, too. He picked me up and popped me into his mouth, there he swallowed me whole, partly because I avoided his teeth. I went down his esophagus and into his stomach. There those nasty juices got to me. I got broken up into pieces. From there I went into the large intestine and into the small intestine. Want to know where I am now? In the toilet!

Joke: What happened to the pea when he entered the mouth?

He came out the other side!

Figure 7- Journal Output-Student E

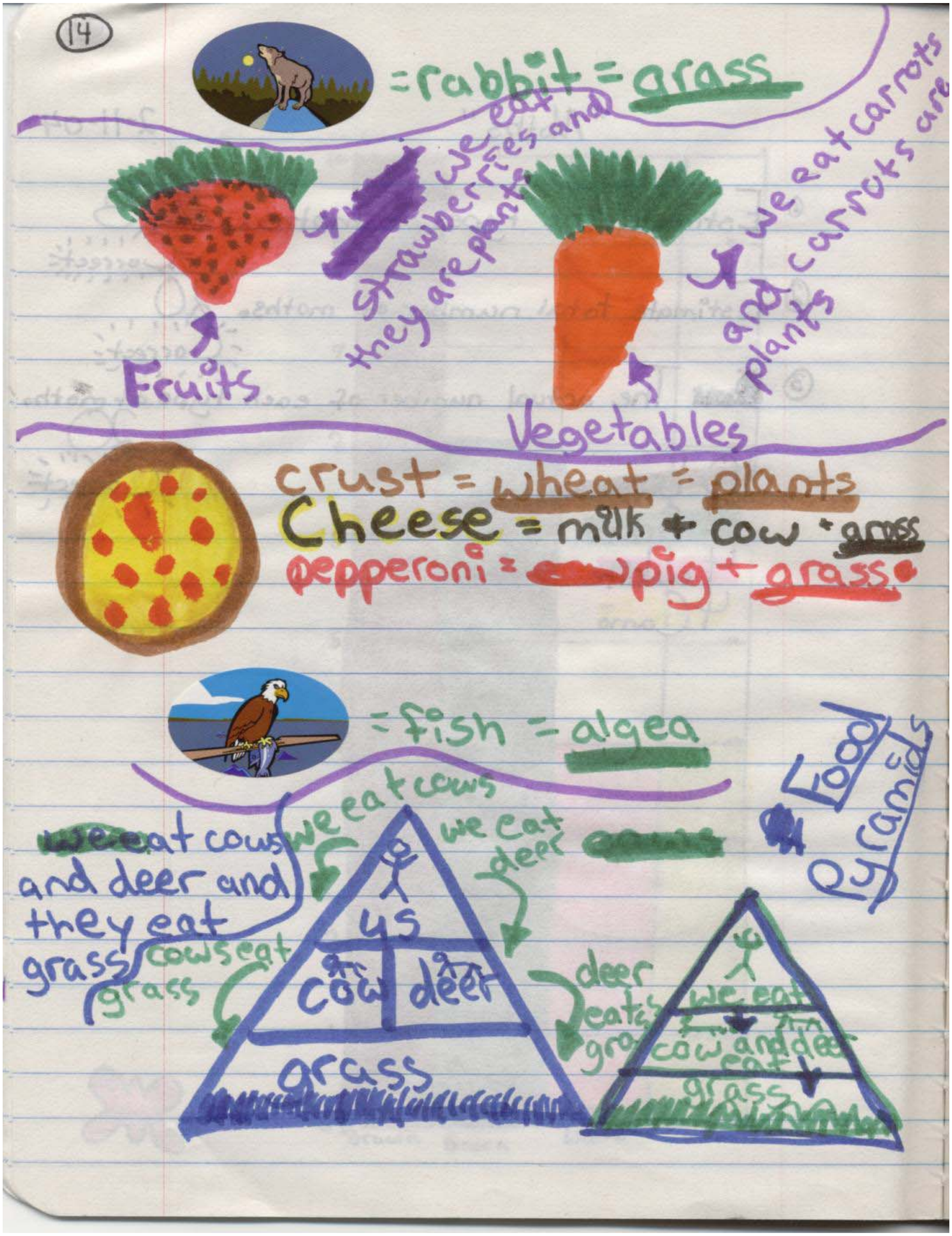

Figure 8- Journal Output-Student F